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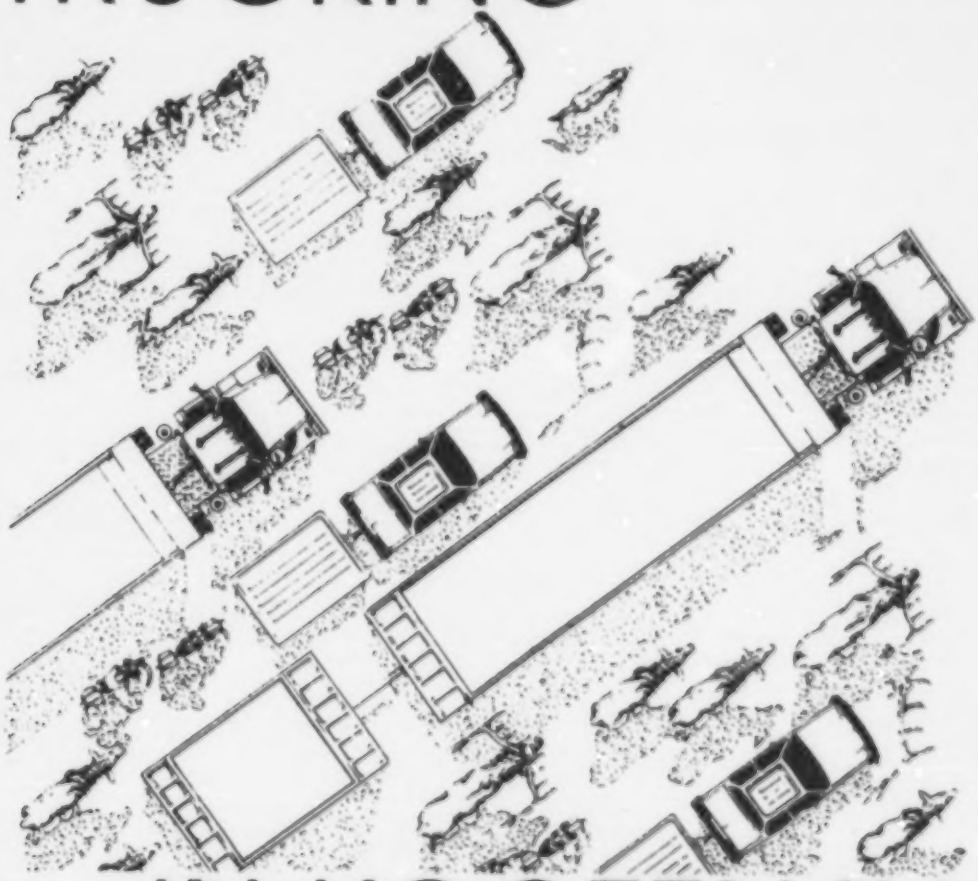
Initial Environmental Evaluation

COMMERCIAL TRUCKING



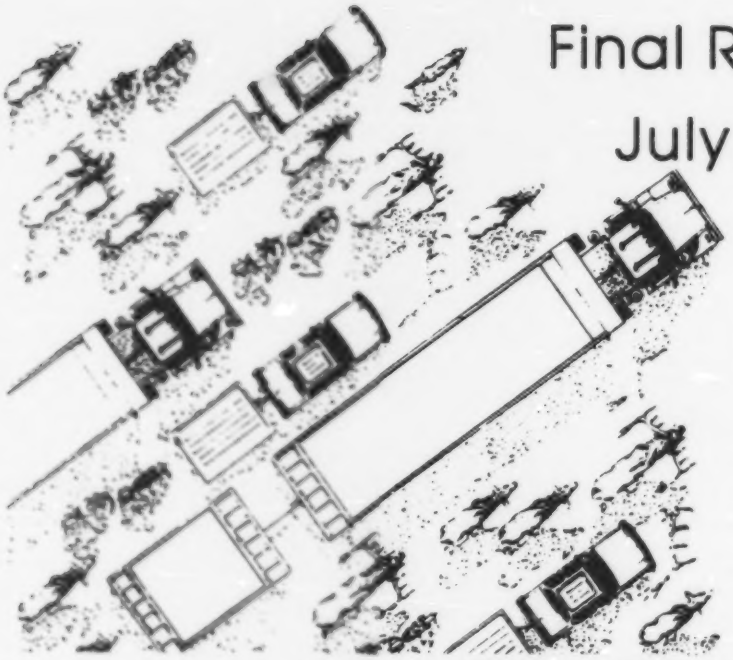
IN KOOTENAY NATIONAL PARK

FINAL REPORT July, 1991

Canada

Initial Environmental Evaluation

COMMERCIAL TRUCKING IN KOOTENAY NATIONAL PARK



Final Report

July, 1991

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92-01781/

EXECUTIVE SUMMARY

The Kootenay Parkway stretches the length of Kootenay National Park, linking Alberta with the Columbia Valley in British Columbia. The Parkway originally was constructed as a park road and transportation link, but since the 1960s has been used by industry for commercial transport. A secondary road, Settler's Road, links the Kootenay Parkway to locations south–east of the park.

This Initial Environmental Evaluation (IEE) examines how the Kootenay Parkway affects the protection and use of Kootenay National Park. Because of previously identified concerns, the IEE focusses on impacts related to commercial trucking.

A year–long investigation into ungulate mortality along the Kootenay Parkway concluded that wildlife/vehicle collisions were a serious concern, particularly to park elk populations. Big trucks are implicated in a disproportionately large share of the mortalities.

A summer visitor survey indicated that most park visitors did not find truck traffic to be in conflict with their enjoyment of the park. It is likely, however, that some visitors — bicyclists, for example — may not be as tolerant as the survey sample which consisted primarily of drivers of motor vehicles.

A number of mitigation measures are recommended to reduce current impacts and to minimize consequences from increased traffic. The most important are:

- enforce the existing speed limit, and
- increase driver awareness of the times and locations of high hazard for vehicle/wildlife collisions.

The possibility of scheduling commercial truck traffic to avoid time periods when the potential for ungulate kills is highest (eg. periods of darkness in October - November and June - July) was examined. This restriction is not recommended at this time because of severe impacts to resource industries, and the potential success of other mitigating measures. Should unacceptable impacts to wildlife continue, this condition will require reconsideration.

Increased commercial trucking would intensify conflicts with park resources and visitor use of Kootenay National Park if continued under the conditions now in effect. It appears, however, that a variety of mitigation measures could reduce the impacts associated with current levels of traffic on the Kootenay Parkway. If mitigating measures prove to be effective, it may be possible to increase commercial trucking without significant negative effects to park resources or the enjoyment of the park by visitors. Unlimited or uncontrolled increases are not acceptable.

ACKNOWLEDGEMENTS

This report would not have been possible without the help and guidance of a number of people.

Commercial users of the Kootenay Parkway willingly provided constructive and useful advice. Baymag Mines Ltd. (Dr. Hagen Schultes and Mr. Heinz Fergen) have been involved from the beginning. Assistance has also been provided by many others from the industry, including Mr. M.H. Fox (Cascade Carriers), Mr. Ian Fraser (Wescan Bulk Transport Ltd.), Mr. Rick Jarrett (Wesroc Industries), Mr. J. Robert Martin (Lafarge Canada), Mr. C. McGregor (Cominco Fertilizers), Mr. S. Ostrander (Slocan Group), and Mr. John Wolfe (John Wolfe Construction Ltd.).

Information provided by the staff of Kootenay National Park, especially Mr. Brian Sheehan of the Warden Service, forms the substance of the report. Mr. Fred Bamber, Superintendent, gently provided the encouragement which kept the project from sliding into oblivion.

Information and analysis provided by Mr. Dave Poll, Canadian Parks Service Wildlife Biologist, are the basis for the main recommendations contained in this report.

Dr. Bruce Leeson, Chief, Environmental Assessment Division, gave encouragement and wisdom.

Finally, it means little until it gets onto the paper. Mr. Marvin Hayne and Ms. Marilyn Yeo of the Publication Design Unit made it happen.

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1.0 THE PROJECT

1.1 INTRODUCTION

Kootenay National Park occupies 1406 km^2 in the Rocky Mountains of southeastern British Columbia (Figure 1). It is contiguous with three other Rocky Mountain national parks (Jasper, Banff and Yoho).They arethe core of the Canadian Rocky Mountain Parks World Heritage Site (Canadian Parks Service 1983).

Kootenay National Park is approximately 85 km from north to south and about 15 km in width (Walker et al, 1984a). The Kootenay Parkway bisects the park lengthwise. It provides access to park facilities and serves as a link between Alberta (Castle Junction) and the Columbia Valley (Radium Hot Springs) in British Columbia (Figure 1).

Commercial trucking has occurred on the Kootenay Parkway since the early 1960s (Huculak, 1978). In 1980, industry requested to increase trucking on Settler's Road, a connector to the Kootenay Parkway. This prompted the Canadian Parks Service (1980) to prepare an environmental impact assessment to address the potential impacts of increased commercial trucking to park environmental and social values. That report concluded that commercial trucking could not be accepted as a long-term operation in the park, and recommended that industry and government develop a mutually acceptable alternative to using the Kootenay Parkway. In the interim, permission continued to be granted to industrial users to haul on Settler's Road on a restricted basis (Table 1).

The preparation of a park management plan for Kootenay National Park (1988) once again identified the need to address the conflicts between commercial trucking and park resources and uses. As a result, this Initial Environmental Evaluation (IEE) has been prepared to examine the environmental implications of commercial transportation in Kootenay National Park, primarily along the Kootenay Parkway. This IEE reports on investigations about the conflicts between use of the Parkway by commercial vehicles and the protection of park resources and enjoyment of the park by visitors. It has been prepared by the Canadian Parks Service to meet the intent of the 1984 *Environmental Assessment and Review Process Guidelines Order*.

1.1.1 Park Development and the Kootenay Parkway*

Mr. Robert Randolph Bruce, a Scottish engineer living in Invermere, British Columbia, believed that construction of a motor road linking Banff with the Windermere district in British Columbia would provide both a valuable commercial link with the province east of the Rockies and would be an attractive tourist route.

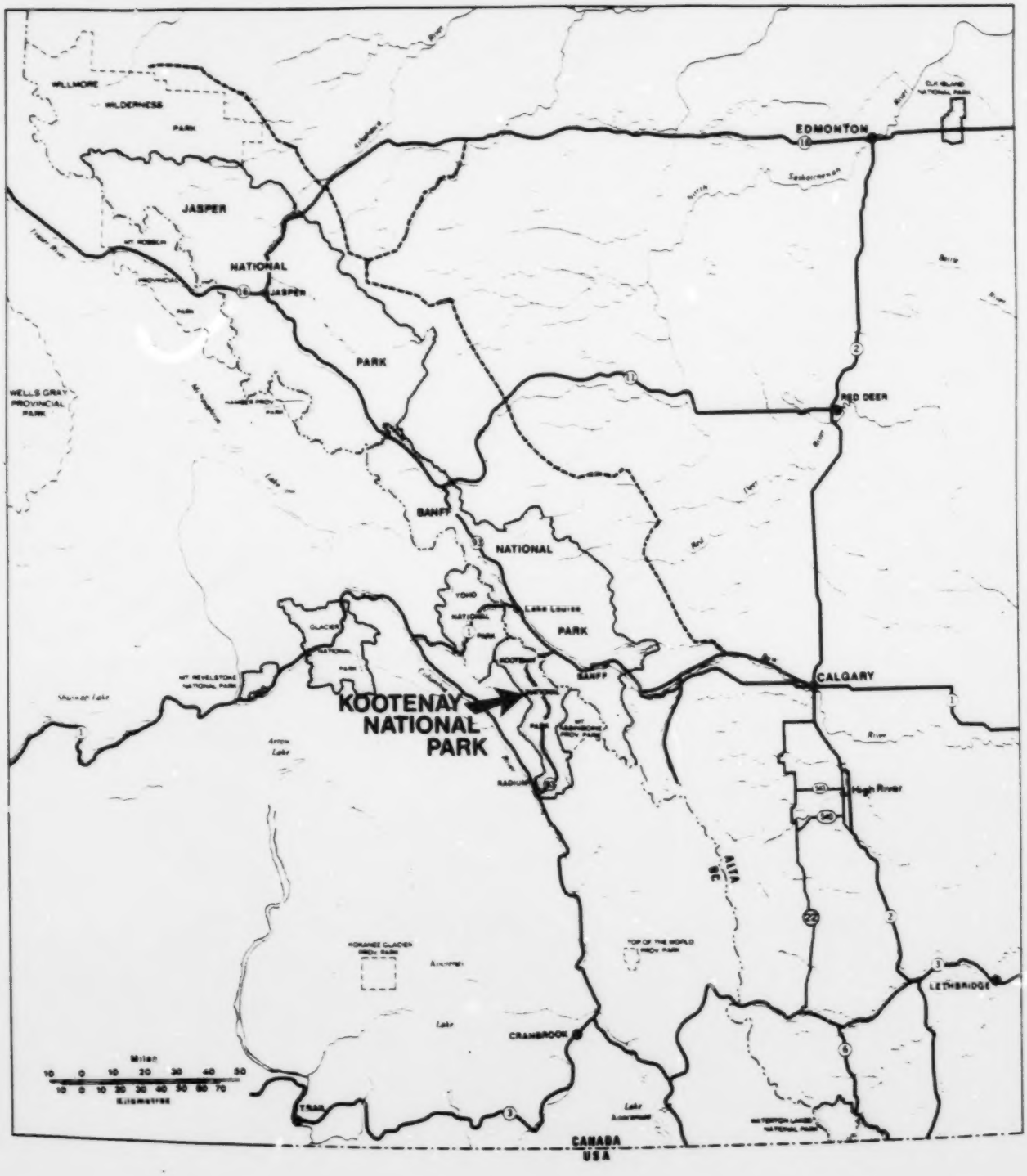
He interested both the Canadian Pacific Railroad and the British Columbia government in the project and the two groups agreed to share in the cost of constructing a road from Windermere to Vermilion Pass. This route was to meet at the Pass with a road from the east, being constructed by the Federal Department of the Interior.

Construction began in 1911, but was suspended in 1913 because of a lack of funds. Only 20 km had been completed. Meanwhile, the Federal Government constructed the stretch of road through Banff, completing it to the inter–provincial boundary at the summit of Vermilion Pass by November 1914.

Mr. Bruce advocated the continuation of construction of the road from Windermere. In 1919, his campaign successfully culminated when the *Banff–Windermere Road Agreement Ratification Act* was signed on behalf of British Columbia and the Federal Government (Lothian 1976).

* also has been known as Highway 93, Banff–Windermere Highway and Banff–Windermere Road.

Figure 1: Regional Setting of the Kootenay Parkway



The province agreed to give to the Dominion Government:

> *the said road in so far as it lies in the province of British Columbia and a strip of land ten (10) miles in width lying five (5) miles on each side of the said road.*

In exchange,

> *The Dominion Government shall, within four years from the conclusion of the peace in the present war, complete the construction of the portion of the Banff–Windermere Road extending from its intersection with the Golden–Windermere Road at Sinclair Creek, in the District of Kootenay, to the eastern boundary of the province. . .*

and

> *The Dominion Government agrees that it will hereafter maintain the road as a public highway during the months of May to October, both inclusive.* (Province of British Columbia 1919)

In 1920, Kootenay National Park was established and highway construction commenced. Three years later, on June 23, 1923, the road was officially opened at Kootenay Crossing. Four thousand five hundred vehicles travelled the new route between the Columbia River Valley and Banff in the following tourist season (Lothian 1976).

The Kootenay Parkway now serves as an important link between the Columbia River Valley and Alberta. Its major users are park visitors, commuters between Alberta and recreational properties in the Columbia Valley, and commercial haulers, primarily of raw resource materials (gypsum, magnesite ore and forest products).

1.2 SETTLER'S ROAD

Settler's Road is a secondary road which crosses the southern edge of the park for approximately 11 km. It connects secondary roads along the Palliser and Cross rivers to the Kootenay Parkway. Settler's Road is an important commercial hauling link for forest products going south through Radium Hot Springs and for ores bound for processing in Alberta. Settler's Road is maintained largely by the industrial users (Turnbull, 1981). Although it is used primarily by resource extraction industries, during one summer sample, 57% of the vehicles on the road were for recreational use (McDonough et al 1985).

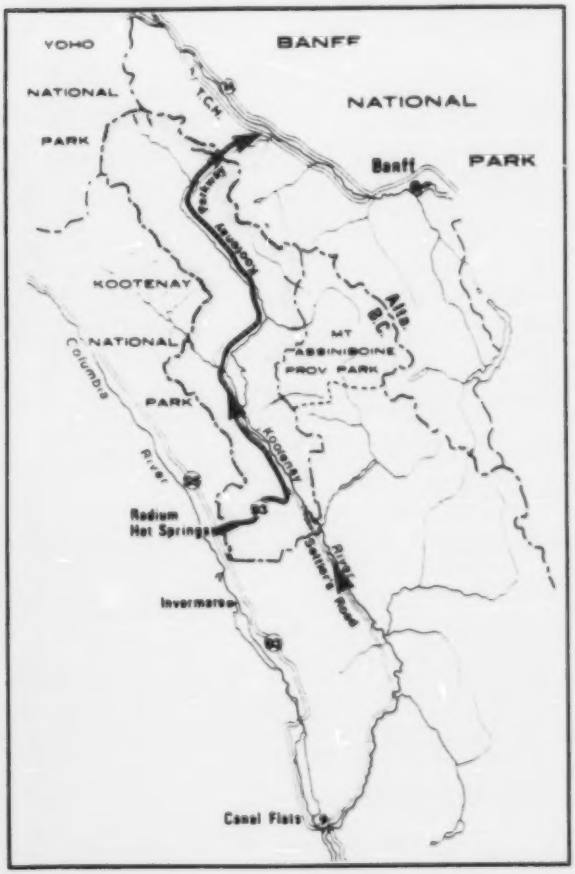
The existence of Settler's Road predates the designation of the area as a National Park. Mr. Rae, Superintendent of Kootenay National Park, wrote to the Regional Director (Rae 1965):

> *Mr. Peatfield is of the opinion that the Settler's Road was in existence for quite a number of years before Kootenay National Park came into being. He informed me that a considerable amount of property which is now adjacent to the southeast boundary of the park was sub–divided in the early 1900's, and consisted of numerous farms, ranches, and at least one hunting lodge, and that Settler's road was built and maintained as an access to these properties.*

All commercial hauling on Settler's Road requires permission of the National Park Superintendent. Permission to use the road for log hauling was given as early as 1952, to Wilder Brothers (now Slocan Forest Products Limited of Radium Hot Springs) (Canadian Parks Service 1980). The two major commercial operators on Settler's Road during recent years have been Slocan Forest Products and Baymag Mines Limited.

Slocan Forest Products hauls logs from its logging operation south east of Kootenay National Park to mills in Radium, passing south along the Kootenay Parkway through the busy Aquacourts area at Sinclair Canyon (Figure 2). Conditions for their use of the road have varied with limitations on hours, days of the week and seasonal operations. Until recently, for instance, trucking was not allowed during the summer. Currently, Slocan Forest Products is permitted to haul approximately 8 loads per day, Monday to Friday (Table 1).

Figure 2: Haul Route, Slocan Forest Products



Baymag Mines first gained permission to haul 11 truckloads of ore along Settler's Road in 1977 (Figure 3). In winter 1980-81, permission was granted to haul 6000 tonnes of magnesite ore on an experimental basis in order to evaluate the success of ore processing facilities at the Steele Brothers plant at Exshaw, Alberta (Mudry 1980). Prior to 1983, commercial hauling on Settler's Road had not been allowed during the summer except under exceptional circumstances, but in 1983, Baymag gained permission to haul up to 16 loads of ore per day over Settler's Road during July and August. For the 1989-90 operating year, Baymag was permitted to ship approximately 18 loads/day.

Figure 3: Haul Route, Baymag Mines Ltd.

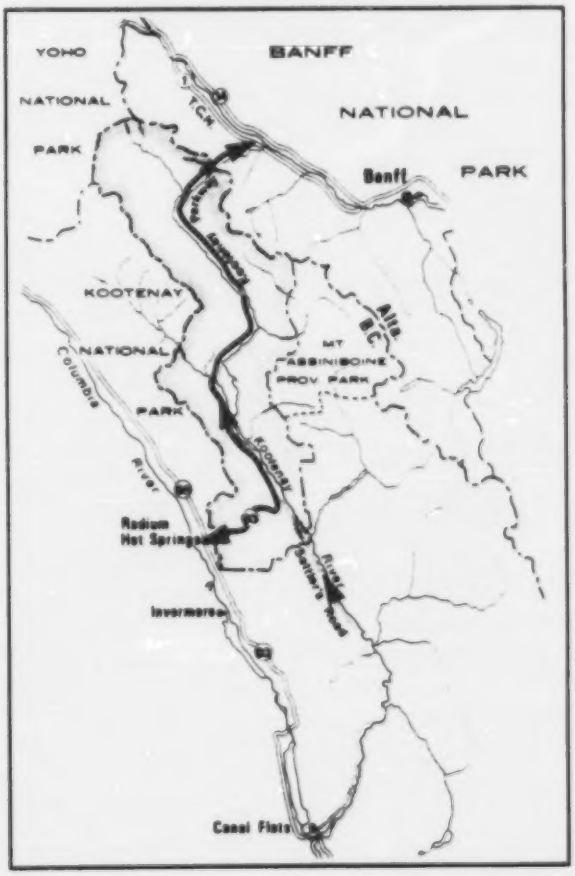


Table 1: Summary of Permits Issued for Commercial Traffic on Settler's Road, Kootenay National Park (1969–1989) (Kootenay National Park file 2790–1/100/K2)

Period of Permit	Permittee	Maximum Loads/Day	Days of Operation	Hours
09/69–03/70	Radium Forest Products	9 trucks	n/a	n/a
11/70–03/71	Radium Forest Products	30	n/a	n/a
09/71–03/72	Radium Forest Products	12 trucks	n/a	n/a
10/72–03/73	Radium Forest Products	50	n/a	n/a
09/73–03/74	Radium Forest Products	15	24/09–28/09	n/a
	Radium Forest Products	15	01/10–05/10	n/a
	Radium Forest Products	50	09/10–31/03	n/a
05/74–06/74	Radium Forest Products	10	Mon.–Thurs.	'til 1900
			Fridays	'til 1800
09/74	Radium Forest Products	20	23/09–30/09	n/a
10/74–03/75	Radium Forest Products	70	n/a	n/a
06/75	Radium Forest Products	10	Mon.–Fri.	0600–1400
08/75	Mr. & Mrs. Stoshnof	1	1 day only	n/a
09/75	Acres Consulting Co.	1 or 2	1 day only	n/a
10/75	H. Seel & Sons	6 only	1 day only	n/a
10/75–03/76	Radium Forest Products	25	n/a	n/a
06/76	Radium Forest Products	25	Mon.–Thurs.	n/a
07/76	Radium Forest Products	25	Mon.–Thurs.	0400–1600
09/76–03/77	Radium Forest Products	50	n/a	n/a
06/77	Radium Forest Products	25	Mon.–Thurs.	0400–1600
08/77	Baymag Mines	11	2 days only	start 0600
09/77–03/78	Radium Forest Products	60	Mon.–Fri	n/a
05/78–06/78	Radium Forest Products	30	Mon.–Fri	0630–1600
09/78–03/79	Radium Forest Products	70	Mon.–Fri.	0400–1800
05/79	Domtar Chemical Group	Max. 2	Mon.–Fri.	0600–1800
05/79–06/79	Radium Forest Products	70	Mon.–Fri.	0500–1900
07/79	Baymag Mines	4	1 day only	n/a
09/79–03/80	Radium Forest Products	65	Mon.–Fri.	0400–1900
05/80–06/80	Radium Forest Products	20	Mon.–Fri.	0500–1800
07/80–08/80	Radium Forest Products	3	Mon.–Fri.	0400–1800
09/80–02/81	Baymag Mines	6000 tonnes	n/a	n/a
09/80–03/81	Radium Forest Products	50	Mon.–Fri.	0400–1800
05/81–06/81	Radium Forest Products	50	Mon.–Fri.	0400–1800
09/81–03/82	Radium Forest Products	50	Mon.–Fri.	0400–1800
06/82	Baymag Mines	20	Mon.–Fri.	0400–1800
08/82–03/83	Radium Forest Products	30	Mon.–Fri.	0430–1800
08/82–09/82	Baymag Mines	4	Mon.–Fri.	0400–1800
02/83	Baymag Mines	n/a	Sat. only	n/a
02/83	Radium Forest Products	n/a	Sat. only	n/a
05/83–06/83	Radium Forest Products	40	Mon.–Fri.	0400–1800
06/83–09/83	Baymag Mines	8	Mon.–Fri.	2200–1800
07/83–09/83	Baymag Mines	16	Mon.–Fri.	0430–1800
09/83–03/84	Baymag Mines	10	Mon.–Fri.	0400–1800
11/83–03/84	Radium Forest Products	45	Mon.–Fri	0500–1800
01/84–03/84	Blue Ridge Forest	4	Sats. only	0500–1800

n/a - not available

cont .....

Table 1 – Continued

Table 1: Summary of Permits Issued for Commercial Traffic on Settler's Road, Kootenay National Park (1969–1989) (Kootenay National Park file 2790-1/100/K2)

Period of Permit	Permittee	Maximum Loads/Day	Days of Operation	Hours
01/84–03/84	Barwell Resources	7	Mon.–Fri.	0400–1800
01/84–03/84	Broen Logging	6/wk	Mon.–Fri.	0500–1800
03/84–04/84	Broen Logging	7–8/wk	2 week period	n/a
02/84–03/84	H. Seel and Son's Mill	6	Mon.–Fri.	0400–1800
03/84	H. Seel and Son's Mill	9	1 Saturday only	n/a
04/84	H. Seel and Son's Mill	10	Mon.–Fri.	0600–1800
04/84–06/84	Baymag Mines	12	Sun. eve.–	2200–1000
			Mon. morn.	n/a
05/84–06/84	Radium Forest Products	20	Mon.–Fri.	0400–1800
07/84–08/84	Baymag Mines	12	Sun. eve.–	2200–1000
			Sat. morn.	n/a
07/84–08/84	Radium Forest Products	20	Mon.–Fri.	0400–1800
12/84–03/85	Blue Ridge Forest	6	Mon.–Sat.	0400–1800
12/84	H. Seel and Son's Mill	6/wk	Mon.–Fri.	0600–1800
03/85	H. Seel and Son's Mill	Total 6–8	Saturdays only	n/a
03/85	Blue Ridge Forest	2	Sunday only	before noon
05/85–09/85	Radium Forest Products	20	Mon.–Fri.	0400–1800
06/85–07/85	Mr. S. Fitzpatrick	8	Mon.–Fri.	0400–1800
05/86–08/86	Radium Forest Products	25	Mon.–Fri.	0400–1800
06/86–03/87	Baymag Mines	18	Mon.–Fri.	0400–1800
07/86–03/87	Radium Forest Products	25	Mon.–Fri.	0500–1800
			+ 3 Sat.	n/a
08/86–03/87	Baymag Mines	18	Mon.–Fri.	0200–1400
09/86–03/87	Blue Ridge Forest	n/a	Mon.–Fri.	0500–1800
10/86–11/86	B.E.L. Logging	approx. 8/day	Sat	0500–1800
		Total 250 loads	n/a	n/a
04/87–03/88	Baymag Mines	18	Mon.–Fri.	0200–1400
05/87–03/88	Brisco Wood Preservers	2–6	Mon.–Fri.	0500–1800
06/87–03/88	Radium Forest Products	8	Mon.–Fri.	0500–1800
01/88–03/88	Blue Ridge Forest	3	Mon.–Fri.	0500–1800
04/88–03/89	Radium Forest Products	8	Mon.–Fri.	0500–1800
11/88–08/89	Thierbach Contracting	3	Mon.–Fri.	0500–1800
04/89–03/90	Baymag Mines	approx. 18/day	Mon.–Fri.	0200–1400
		Total 4,703 loads		

n/a - not available

Baymag Mines' future hauling requirements will vary depending on the demands of processing facilities in Alberta.

Until recently, Settler's Road was too narrow in some places for 2-way traffic, and its intersection with the Parkway was difficult for loaded trucks to negotiate safely. In 1985, the commercial users upgraded the road so that it can now accommodate 2-way traffic along its entire length. Increased magnesite ore hauling will probably require further upgrading to harden the road and further increase clearance. Upgrading the intersection of Settler's Road and the Kootenay Parkway is currently being considered (Hammer 1989).

1.3 KOOTENAY PARKWAY

The Kootenay Parkway was officially opened on June 23, 1923 (Lothian 1976). It was reconstructed in stages between 1958–1969 with many sections having been overlayed since then. It has been upgraded from an all–weather gravel road to a highway with 13.2 m – 13.5 m paved width. This width accommodates two 3.6 m wide driving lanes and two 3.0 m shoulders. The Parkway is the focus of park visitor use and provides access to park facilities. Most of the intersections for these facilities do not meet modern highway safety standards such as lane and shoulder widths and sight distances, and remedial action is currently being considered (Hammer 1989).

Until 1988, traffic statistics for the Kootenay Parkway were available only for northbound traffic through the west park gate, located in Radium. Traffic which entered the park via Settler's Road was not included. In 1988, traffic counters were installed at a number of locations on the Parkway, providing more accurate and realistic traffic data. In 1988, 477,900 vehicles passed northbound through the west park gate at Radium. Of these, 3.3% (15,700) were trucks (Table 2). Elsewhere on the Kootenay Parkway, heavy trucks constituted 6.3% of the traffic stream (Table 3).

Traffic varies widely throughout the year, week and day. Summer average daily traffic is more than triple winter average daily traffic (Table 3). Traffic volumes peak on weekends and statutory holidays, reflecting the use of the Parkway by "recreational commuters" who travel between Calgary and the Windermere area (Morrall 1989) (Figures 4 and 5).

Table 2: Annual Vehicle Traffic, Kootenay Parkway, (1978 – 1990) as Measured at the West Gate (One–way, North Bound Only) (File C8373/K2–102).

Year	Passenger Vehicles	Trucks (% of Total)	Total Vehicles
1978	434,460	23,574 (5.2%)	458,034
1979	473,539	24,925 (5.0%)	498,464
1980	502,579	24,686 (4.7%)	527,265
1981	516,471	25,226 (4.7%)	541,697
1982	492,425	20,132 (3.9%)	512,457
1983	481,753	19,714 (3.9%)	501,467
1984	459,076	19,002 (4.0%)	478,078
1985	438,094	19,011 (4.2%)	457,105
1986	431,311	18,286 (4.1%)	449,597
1987	458,344	16,613 (3.5%)	474,957
1988	462,180	15,718 (3.3%)	477,898
1989	-	-	482,644*
1990	-	-	472,951*

* traffic counter data

Table 3: Composition of Traffic on the Kootenay Parkway (May 1988 to May 1989) (Morrall 1989)

Counting Period	Vehicle Type	Two–Way (veh/day)	Two–Way (%)
Average Annual Daily Traffic	Automobiles	1,142	69.1
	RV's and straight trucks	406	24.6
	Heavy trucks	104	6.3
Summer Average Daily Traffic	Automobiles	2,327	67.9
	RV's and straight trucks	960	28.0
	Heavy trucks	142	4.1
Winter Average Daily Traffic	Automobiles	654	72.7
	RV's and straight trucks	173	19.2
	Heavy trucks	73	8.1

Figure 4: Typical Winter Long Weekend Peaking Characteristics, Kootenay Parkway (Morrall, 1989)

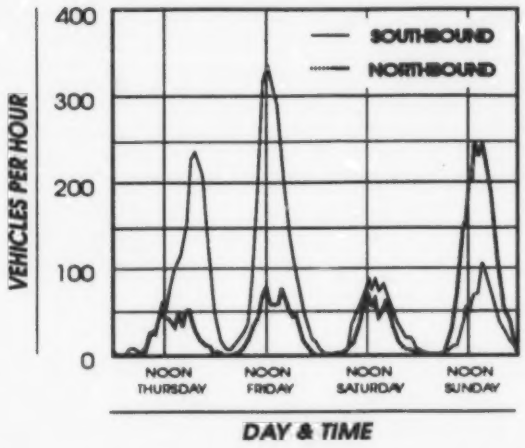
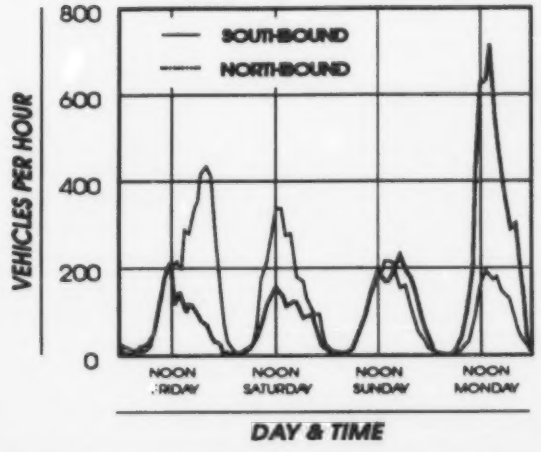


Figure 5: Typical Summer Long Weekend Peaking Characteristics, Kootenay Parkway (Morrall, 1989)



These sharp peaks are highly directional. Annual peak southbound traffic occurs on a Thursday or Friday evening (depending on the day a statutory holiday falls); highest northbound traffic is on the afternoon of the last weekend day. In 1988, during the 10 highest hours for southbound traffic, average southbound volume was 474 vehicles per hour; northbound was 40 vehicles per hour (Socio-Economic Research Division).

Conversely, during the 10 highest hours for northbound traffic on the Kootenay Parkway, northbound traffic averaged 625 vehicles per hour; southbound was 104 vehicles per hour.

The Kootenay Parkway is becoming an increasingly attractive bicycling route. It forms part of the "Golden Triangle", a loop which includes highways in Banff, Yoho and Kootenay national parks. Limited data about bicycle traffic is available (Table 4). Only bicycle traffic northbound along the Parkway at Radium is reported. Therefore, the numbers do not show bicycles which exit the park at Radium, the preferred direction of travel for bicycle tourers.

Table 4: Incoming Bicycles at Kootenay National Park West Gate

	1984	1985	1986	1987	1988
January	n/a	0	0	0	2
February	n/a	0	1	0	0
March	n/a	11	28	0	16
April	38	48	24	75	32
May	140	121	122	158	163
June	188	177	196	187	208
July	304	320	323	452	314
August	273	358	327	305	358
September	81	72	59	79	131
October	13	14	40	27	39
November	4	0	0	12	0
December	0	0	0	0	0
Total	1037*	1121	1120	1295	1263

n/a = not available

* = based on incomplete data

The capacity of the Kootenay Parkway, along with other highways in Banff, Jasper, Kootenay and Yoho national parks, was analysed in a 1984 report prepared for the Four Mountain Parks planning program. Rouse (1984) determined that the level of service on the Kootenay Parkway in 1982 was free flowing, with the exception of 12 hours in the year, when traffic levels created "Moderate Congestion" (Table 5). Tables 6 and 7 provide similar information, based on projected traffic statistics and measured data. According to these projections, the Parkway is adequate for traffic flow within the forseeable future.

Rouse (1984) cautioned, however, that "the realities of congestion will be worse than stated in the analysis." He explained,

> *This analysis has treated the whole Windermere Highway as a single link and no overall capacity problems are indicated on the planning horizon.*
>
> *However, because of the length of the link (average driving time is about 1 1/3 hours) there are likely subsections where restricted passing opportunities could cause the formation of undesirable platoons. As with the Icefields Parkway, passing lanes would ensure good levels of service on an indefinite basis. However, a necessary first step would be a study of traffic flows on the highway to determine whether selected installations of passing lanes would be an effective measure to upgrade levels of service.*

Studies are currently underway to determine the most effective locations for the addition of passing lanes and intersection improvements along the Kootenay Parkway (Hammer 1989, Morrall 1989).

Table 5: Highways in Banff, Jasper and Kootenay National Parks: Level of Service (Hours per Year) 1982 (Rouse 1984)

LINK	Free Flow[1]	Moderate Congestion	Heavy Congestion	Extreme Congestion	Beyond Max. Flow
T.C.H. Castle to Lake Louise	8148	606	6	0	0
Yellowhead Jasper to W. Gate	8760	0	0	0	0
Icefields Parkway Icefields to Jasper	8760	0	0	0	0
Kootenay Parkway Castle to Radium	8748	12	0	0	0

[1] Free Flow level on the Kootenay Parkway occurs when traffic is less than 450 vehicles per hour; moderate flows occur between 450 and 750 vehicles per hour; heavy congestion occurs between 750 and 1100 vehicles per hour.

Table 6: Highways in Banff, Jasper and Kootenay National Parks: Level of Service (Hours per Year) PROJECTED FOR 1990; ACTUAL FOR 1988 (Rouse 1984; Socio–Economic Research Division data files)

LINK	Free Flow	Moderate Congestion	Heavy Congestion	Extreme Congestion	Beyond Max. Flow
T.C.H. Castle to Lake Louise	7869	634	152	5	0
Yellowhead Jasper to W. Gate	8760	0	0	0	0
Icefields Parkway Icefields to Jasper	8758	2	0	0	0
Kootenay Parkway Castle to Radium	8698 8704*	61 52*	1 4*	0	0

*actual measured data for 1988

Table 7: Highways in Banff, Jasper and Kootenay National Parks: Level of Service (Hours per Year) Projected for 2000 (Rouse 1984)

LINK	Free Flow	Moderate Congestion	Heavy Congestion	Extreme Congestion	Beyond Max. Flow
T.C.H. Castle to Lake Louise	7509	805	379	64	3
Yellowhead Jasper to W. Gate	8740	20	0	0	0
Icefields Parkway Icefields to Jasper	8746	14	0	0	0
Kootenay Parkway Castle to Radium	8631	121	8	0	0

1.4 COMMERCIAL TRUCKING IN KOOTENAY NATIONAL PARK

Concern about highway maintenance costs, and existing and future impacts to park natural resources and visitor use has prompted an investigation of commercial trucking on the Kootenay Parkway. The Parkway was not constructed for truck traffic (Baker 1978), however trucks have been allowed to use the highway since the early 1960s (Huculak 1978). Over two-thirds of commercial truck traffic on the Parkway are carriers who regularly travel the Parkway (B-A Consulting Group Ltd. 1988).

Vehicle counts of traffic north–bound through the park gate at Radium indicate that, consistent with the general traffic volume, truck traffic reached its peak on the Kootenay Parkway in 1981 (approximately 25,200) and has declined steadily since then to approximately 15,700 in 1988 (Table 2). (These statistics do not reflect truck traffic accessing the Kootenay Parkway via Settler's Road.)

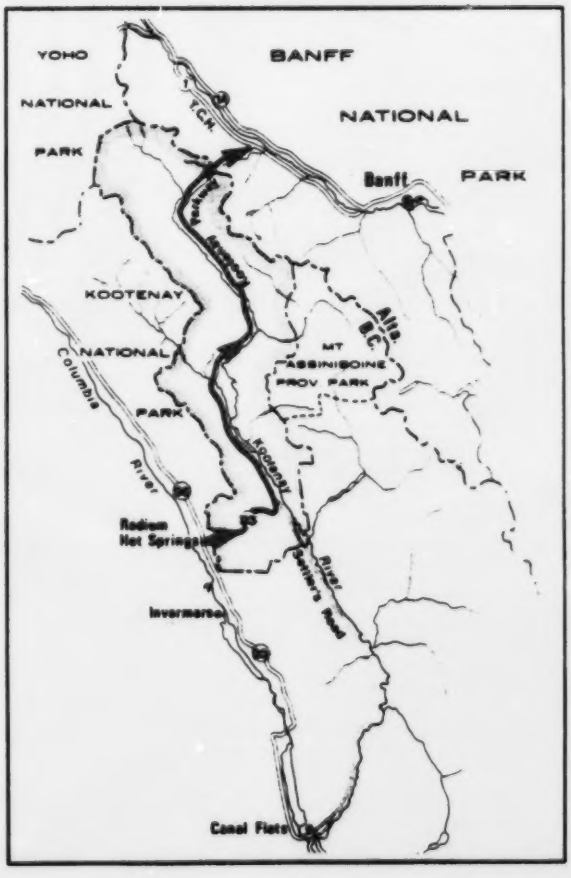
North of Settler's Road, trucks comprised from 2.8% of the traffic stream in August to 15.3% in November (B–A Consulting Group Ltd. 1988). The annual average of trucks in the daily traffic stream is 6.3% (Morrall 1989). This variation is because large truck volumes remain relatively constant throughout the year, while passenger vehicle traffic balloons during the summer months. (This compares with a traffic mix containing 5.2% trucks on the Trans Canada Highway in Banff (Brunell 1985)).

A number of major resource industries use the Parkway to deliver their products with trailer truck trains. Baymag Mines Limited mines magnesite ore "from the purest crystalline magnesite deposit on earth" on the slopes of Mount Brussilof, south-east of Kootenay National Park (Baymag Mines Limited). The ore is hauled via Settler's Road and the Kootenay Parkway to Exshaw, Alberta for processing (Figure 3).

Lafarge Canada Limited depends heavily on the Kootenay Parkway for transporting dry bulk commodities. The Exshaw plant of Lafarge Canada Limited supplies cement to customers in the East Kootenay area via the Kootenay Parkway. In order to meet customer demands for delivery, 24 hour access to the Parkway is required.

Westroc Industries in Invermere, B.C. supplies large quantities of gypsum rock to the Lafarge Exshaw plant. This gypsum is transported from Invermere to Exshaw via the Kootenay Parkway on a year round basis, with heaviest production occurring during March - November and in dry weather. In order to fully use equipment, 24 hour access to the Parkway on a year round basis is required (Figure 6).

Figure 6: Haul Route, Westroc Industries



Iron calcine from Cominco Fertilizers in Kimberley, B.C. is used as a source of iron by Portland Cement manufacturers (Lafarge and Inland) in Exshaw and Edmonton, Alberta. It is subject to a short hauling season (mid-April to mid-October) because it cannot be loaded or unloaded during cold weather. To maximize equipment use, 24 hour access to the Parkway is required.

These commodity producers and processors contract to independent trucking businesses. Westcan Bulk Transport, Cascade Carriers and J. Wolfe Construction Company provide a significant portion of the hauling services which use the Kootenay Parkway.

Slocan Forest Products (previously Radium Forest Products) is also an important commercial user of the roads in Kootenay National Park. Logging trucks access the Kootenay Parkway from Settler's Road and haul to mills in the Radium area. Processed lumber from Radium to Calgary is also transported along the Parkway.

In addition to these major carriers, other commercial transport on the Kootenay Parkway includes grocery delivery, petroleum product delivery and other general purpose hauling.

Because of the close relationship between methods to control impacts related to traffic on the Kootenay Parkway, and the trucking and resource extraction industries, a Standing Committee composed of Canadian Parks Service staff and industry representatives has been established to provide ongoing consultation about issues of mutual concern.

The impact of commercial hauling on the pavement and its implications to highway maintenance and reconstruction have been evaluated. Theoretically, existing and projected levels of commercial trucking on the Kootenay Parkway should be accommodated within the structural design loads for this road (Cook 1986; Arnett 1988). However, the Parkway is showing severe deterioration. A number of factors have been implicated in pavement degradation including chainwear from heavy trucks, asphalt mix design, aggregate problems and overweight vehicles. Overweight vehicles are of special concern as they can reduce roadlife by 50% or more (Seaby 1986). Spot checks of trucks on the Kootenay Parkway have revealed significant overloading by commercial carriers (Bamber 1988). Results of work elsewhere (Better Roads, 1990) reveal that heavy truck traffic is the single most important variable influencing pavement maintenance costs. Average road maintenance cost per vehicle is approximately 100 times greater for heavy trucks compared to cars and light trucks.

The Kootenay Parkway feeds onto the Trans Canada Highway in Banff National Park. Any increase in commercial trucking on the Kootenay Parkway is unlikely to have a noticeable influence on Trans Canada Highway traffic volumes because of the relatively high traffic flow currently experienced on the Trans Canada Highway. Average annual daily traffic on the Trans Canada Highway at the Banff East Gate in 1988 was 11,457 vehicles (two-way) (Socio-Economic Research Division).

1.5 REGIONAL CONTEXT

1.5.1 Tourism

Kootenay National Park shares its boundary with other national and provincial parks (Figure 1). Kootenay, together with its neighbour parks, Yoho National Park, Banff National Park and Assiniboine Provincial Park, forms a carefully protected land mass which has important watershed and wildlife values and serves as a tourist attraction for international as well as national and local visitors.

Tourism is the principal industry of the Columbia–Windermere Lakes area west of Kootenay National Park (Novacorp et al 1982). Approximately 16% of the 1.2 million annual visitors to the larger Kootenay Tourist Region are Alberta residents, with an even greater proportion of Albertans – 40 - 55% – comprising the visitor population in the Columbia-Windermere Lakes area. A report prepared in 1980 (Thompson et al 1980) estimated that in the Kootenay Tourist Region, tourism generated $170 million in revenue, with approximately 19% of this generated in the Columbia–Windermere lakes area. The Kootenay Parkway is the access route to this area for a large proportion of the Alberta visitors.

The major visitor attractions centre around the wilderness and natural beauty of the region. In a survey of summer visitors, 57% identified sightseeing / relaxation / scenery as their major recreational activity. Hot springs were also popular— 19%, with swimming chosen third — 11%. Walking / hiking / climbing was chosen by 3% of visitors as their principal recreational activity (Thompson et al 1980). Kootenay National Park provides high quality opportunities for area visitors to participate in these activities.

The recommendation of the Steering Committee which directed the Thompson et al study emphasized the importance of environmentally sympathetic tourism development:

In consideration of the recommended strategy for the Columbia – Windermere Lakes area, it cannot be emphasized enough that the natural resources of this area are unique, and consequently are of Provincial and regional significance. . . .

The significant recreation and tourism potential of the [area between Fairmont Hot Springs and Radium Hot Springs] should be given serious consideration in the management of other resource uses and Crown lands in the Columbia- Windermere Lakes area as a whole. In this regard, coordination among various agencies and levels of government is essential.

. . . future development of any additional mining operations should be carefully planned in order to minimize the impacts to tourism and other resource use activities.

1.5.2 Resource Extraction

Outside of the National and Provincial Parks, a number of resource extraction activities which contribute to the local economy affect Kootenay National Park. Logging in the Cross River and Mitchell River regions has long depended on the use of Settler's Road and the Kootenay Parkway for access to sawmills in Radium. Lumber products are then hauled to Alberta by trucks using the Kootenay Parkway.

Gypsum is mined at Invermere and hauled along the Kootenay Parkway for processing at plants in Alberta and elsewhere east of the Continental Divide.

Magnesite ore is mined on the slopes of Mount Brussilof, south-east of Kootenay National Park. The ore is hauled via Settler's Road and the Kootenay Parkway to Alberta for processing.

Some of these industries have developed under conditions allowed by access through the park and are unlikely to survive if that access is cut off. For others, there may be economically viable alternate transportation routes.

Big game hunting, both by private parties and by people using the services of commercial guides and outfitters, is an important local activity. These users comprise a large proportion of small vehicle traffic on Settler's Road during the fall.

1.5.3 Transportation Through the Rockies

The Rocky Mountains are a formidable barrier to east-west movement of goods and people. Three major transportation routes now cross these mountains :the Yellowhead Highway through the Yellowhead Pass, the Trans Canada Highway (TCH) through Kicking Horse Pass, and Highway #3 through the Crowsnest Pass. Transcontinental rail lines also use these passes (CNR in the Yellowhead, CPR through the Kicking Horse and the Crowsnest). The Parkway through Vermilion Pass does not serve as a transcontinental transportation route, although it does connect areas of the Columbia Valley to the Trans Canada Highway in Banff, and points east. No rail line is located through the Vermilion Pass (in Kootenay).

Table 8 provides an estimate of the increased costs to industry of using alternative transportation routes. Table 9 indicates the comparative distances of travel along the Kootenay Parkway and alternate routes — the Trans Canada Highway (through Golden) and the Crowsnest Pass.

Table 8: Costs to Industry of Using Alternate Transportation Routes

Product	Origin	Destination	Route	Cost Factor*
cement	Exshaw	East Kootenay area	Kootenay Parkway	100%
	"	"	Highway 25 & TCH (via Golden)	120
gypsum	Invermere	Exshaw	Kootenay Parkway	100%
	"	"	Highway 25 & TCH (via Golden)	155%
iron calcine	Kimberley	Exshaw	Kootenay Parkway	100%
	"	"	Highway 25 & TCH (via Golden)	135%

* Cost factors are approximate, and calculation methods vary depending on industry

Table 9: Distance Implications of Alternatives to the Kootenay Parkway
(B–A Consulting Ltd. 1988)

ORIGIN AND DESTINATION	DISTANCE (km)		
	Kootenay Parkway	TCH (Golden)	Crowsnest Pass
Calgary – Radium	259	367	557
Calgary – Cranbrook	404	512	432
High River – Baymag	320	458	546
Exshaw – Baymag	191	417	675
Exshaw – Radium	171	279	645

2.0 PARK POLICY AND NATIONAL PARK VALUES

2.1 LEGISLATION AND POLICY REQUIREMENTS

The Kootenay Parkway stretches from Radium Hot Springs at the south end of Kootenay National Park to Castle Junction in Banff National Park. It provides access to park facilities and features and to the Columbia Valley in British Columbia. Unlike the TransCanada Highway (in Banff and Yoho national parks) and the Yellowhead (in Jasper National Park), the Parkway is not a national transportation route.

Because the Parkway is pivotal to visitor use of Kootenay National Park, it is important that it reflects park values, and projects the atmosphere and image of what the national park is. Legislation, national park policies and approved management plans state the purpose of national parks, and provide direction on the determination of park values. These values are key to assessing the significance of impacts in the environmental assessment process.

2.1.1 Legislation and Regulations

The *National Parks Act* provides the philosophical direction for the management of National Parks:

> *The Parks are hereby dedicated to the people of Canada for their benefit, education and enjoyment, subject to the provisions of this Act and the Regulations, and such Parks shall be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations.*

The *National Parks Act* also contains sections which provide enabling legislation for the management of roads within a National Park, including controlling use and collecting fees.

2.1.2 Policy and Park Management Plan

To provide more specific direction for the management of National Parks, policy statements (Canadian Parks Service 1979) and a park management plan have been developed.

In Trust for Tomorrow, A Management Framework for Four Mountain Parks (Canadian Parks Service 1986), provided the basis for the Kootenay National Park management plan. It states:

> *The primary emphasis of this Framework is the protection of natural and cultural resources of these Four Parks and this protection takes precedence when conflicts occur, over increased use and development.*

In Trust provides some direction for determining appropriateness of commercial trucking on the Kootenay Parkway. It makes a clear distinction between national transportation corridors (theTrans Canada and Yellowhead highways) and park roads, such as the Kootenay Parkway, which must focus on visitors' enjoyment.

> *Because the railway lines and major highways are nationally significant transportation corridors, decisions about upgrading them must be based on national priorities. It is Parks Canada's responsibility to ensure that existing access routes have as little impact as possible on Park resources and on the quality of visitors' experiences, a mandate to which the Department of the Environment is irrevocably committed.*

Because commercial trucking may affect the way visitors perceive the National Park, statements relating to aesthetics are also of special relevance:

> *The aesthetic effects of existing and proposed land use planning must be evaluated and action taken to minimize those that are negative and to enhance those that are positive. . .*

The aesthetic quality of the Parks will be given the highest priority in all future activities and the impact of daily operation on the aesthetics of the Parks must be minimized.

The Honourable Tom McMillan, Minister of the Environment in 1986 and responsible for Parks explained:

The philosophical foundation of the Plan is simply this: when use and protection clash, protection is to be given priority. . .

We must protect more vigourously the wilderness character of our national parks; . . . threats to heritage values from transportation and utility corridors must be anticipated and dealt with. (McMillan, 1986)

The Kootenay National Park Management Plan (Canadian Parks Service 1988) was prepared based on the foundation laid by *In Trust for Tomorrow*. It states as a management planning principle:

The role of Highway 93 as a parkway (from Castle Junction in Banff National Park to Radium Hot Springs) will be stressed. The parkway is the focus of visitor use in the park, the dominant man–made feature, and the reason for its establishment as a national park. This role will be emphasized to facilitate and enhance a range of experiences and opportunities appropriate to a national park setting. Services and facilities will be provided which enhance the use and enjoyment of the parkway corridor in an essentially natural condition. Particular emphasis will be directed to day–use opportunities, such as those associated with park attractions at picnic sites, viewpoints and roadside interpretive sites.

2.2 DISCUSSION

Legislation and policy clearly indicate that a National Park is intended to serve two purposes:

- protect heritage resources, and
- facilitate visitor use, appreciation and enjoyment of those resources.

Direction for management of the park is also clear – perpetuation and protection of resources take precedence over all other uses. Uses allowed within a park must be compatible with that preservation mandate, and the use should be focused towards the appreciation of that resource. In the past, some activities were permitted in the park which are now considered "nonconforming". Those uses should be removed where possible but in any case, will not be allowed to expand.

It is recognised, however, that National Parks are not managed in isolation from local economic development and neighbouring communities. Clearly, the issue of commercial trucking in Kootenay National Park is one which requires compromise to achieve a solution which allows the National Park to meet its legislated mandate, without distressing the surrounding area.

Management of the Kootenay Parkway must also consider the Parkway's significant role in enhancing the region's tourism industry.

3.0 EXISTING ENVIRONMENT & ENVIRONMENTAL IMPACT

The value of a National Park rests on the significance and integrity of the natural and cultural resources which it protects, and the opportunities it provides to future and present Canadians to understand, appreciate and enjoy those resources.

In this chapter, the resources of Kootenay National Park are described, focusing on the aspects of the resources and resource use which are, or may be, affected by commercial trucking on the Kootenay Parkway or Settler's Road.

The *Ecological Land Classification of Kootenay National Park Volume I* (Achuff et al (eds.) 1984) and *Volume II* (Poll et al 1984) describe the natural resources in Kootenay National Park. Most of the resource description presented here is found in those documents. The *Ecological Land Classification* describes resource characteristics in a hierarchical system. The "ecoregion" is the largest unit, primarily differentiated on the basis of climatic factors (Figure 7). Each ecoregion is subdivided into "ecosections" which are differentiated by landforms and topography. Each ecosection contains one or more "ecosites", differentiated from other ecosites by variation primarily of vegetation type. The Kootenay Parkway and Settler's Road pass through 26 of the 78 different ecosites found in Kootenay National Park. A summary of the resource characteristics of the ecosites through which the roads pass is presented in Table 10.

Figure 7: Ecoregions, Kootenay National Park

Table 10: Biophysical Characteristics of Ecosites Traversed by Settler's Road and the Kootenay Parkway, (Achuff, et.al (eds) 1984)

Ecosite & Ecoregion	Soils	Landform	Vegetation	Remarks
AL3 (Altrude) Lower Subalpine	Eluviated Eutric Brunisol, Eluviated Dystric Brunisol	Fluvial, calcareous, coarse-stratified; apron and fan	Engelmann spruce–subalpine fir forest	0.7% of KNP
AL4 Lower Subalpine	Orthic & Eluviated Eutric Brunisols, Eluviated Dystric Brunisol	as above	lodgepole pine forest	0.5% of KNP
AT1 (Athabasca) Montane	Orthic Eutric Brunisol	Glaciofluvial, calcareous, coarse textured material; terraced	lodgepole pine forest	0.6% of KNP
AT4 Montane	Orthic & Eluviated Eutric Brunisol	Glaciofluvial, calcareous, coarse textured material; fluvial veneer over terrace	white spruce forest	0.7%of KNP
BV2 (Bow Valley) Lower Subalpine	Eluviated Eutric Brunisol	Glaciofluvial, calcareous, coarse textured material; terraced	lodgepole pine forest	0.2% of KNP
BY4 (Bryant) Lower Subalpine	Orthic & Eluviated Eutric Brunisol	Calcareous, variably textured till; hummocky and ridged	Engelmann spruce–subalpine fir forest	0.8% of KNP
BY7 Lower Subalpine	as above	as above	lodgepole pine forest	1.8% of KNP
DG1 (Dry Gulch) Montane	Orthic Eutric Brunisols, Orthic Regosol	calcareous, medium and fine textured colluvium; blanket and veneer over inclined bedrock, apron	Northerly: white spruce–Douglas fir Southerly: Douglas fir forest	2.0% of KNP
DG3 Montane	Orthic Regosol, Orthic Eutric Brunisol, Orthic Humic Regosol	calcareous, medium and fine textured colluvium; veneer over inclined bedrock and ridged bedrock	Douglas fir open forest	1.5% of KNP
DR1 (Daer) Montane	Orthic Eutric Brunisol, Orthic Gray Luvisol	calcareous, medium and fine textured till; veneer and blanket over inclined bedrock	Douglas fir forest	1.9% of KNP
DR2 Montane	as above, and Eluviated Eutric Brunisol	as above	lodgepole pine forest	5.4% of KNP
DR3 Montane	as above	calcareous, medium and fine textured till; veneer and blanket over inclined, hummocky and ridged bedrock	white spruce–Douglas fir forest, mixed wood	2.8% of KNP
DR5 Montane	Orthic Eutric Brunisol, Eluviated Eutric Brunisol, Orthic Gray Luvisol, Orthic Regosol	calcareous, medium to fine textured till, calcareous variably textured drift material; veneer and blanket over inclined bed rock, gullied	white spruce–Douglas fir forest, white spruce forest	2.1% of KNP

Table 10: (continued)

Ecosite & Ecoregion	Soils	Landform	Vegetation	Remarks
DR6 Montane	Orthic Eutric Brunisol, Orthic Gray Luvisol, Eluviated Eutric Brunisol	calcareous, medium to fine texttured till, calcareous variably textured drift material; veneer and blanket over ridged bedrock, hummocky and ridged	white spruce forest, mixed wood	1.6% of KNP
DR7 Montane	Orthic Eutric Brunisol, Eluviated Eutric Brunisol, Orthic Gray Luvisol	calcareous, variably textured drift material; hummocky and ridged	lodgepole pine forest	2.2% of KNP
DR8 Montane	Orthic Eutric Brunisol, ELuviated Eutric Brunisol, Orthic Gray Luvisol, Rego Gleysol, Terric Mesisol	as in DR6	Dry: lodgepole pine forest, Wet: shrubby meadow, wet spruce open forest	2.0% of KNP
FR1 (Fireside) Montane	Orthic Eutric Brunisol Eluviated Eutric Brunisol	calcareous, coarse–stratified fluvial material; fan and apron	lodgepole pine forest	1.0% of KNP
FR3 Montane	as above	as above	white spruce forest, mixed wood	1.8% of KNP
HC1 (Hector) Lower Subalpine	Rego Gleysol, Gleyed Cumulic Regosol	calcareous, coarse–stratified fluvial material; level, fan and apron	wet Engelmann spruce–subalpine fir open forest,wet spruce open forest	0.3% of KNP
HD3 (Hillsdale) Montane	Cumulic and Orthic Regosols	as above	white spruce forest, mixed wood	0.4% of KNP
HD6 Montane	Orthic Regosol, Gleyed Regosol	calcareous, coarse–stratified fluvial material, calcareous coarse–textured glacio–fluvial material; level & terraced, eroded	herb mat	0.5% of KNP
PP3 (Pipestone) Lower Subalpine	Orthic and Cumulic Regosols	calcareous, coarse–stratified fluvial material; apron and level	Engelmann spruce–subalpine fir forest	0.4% of KNP
VL2 (Vermilion Lk) Montane	Rego Gleysol, Terric Mesisol	calcareous, fine–stratified fluvio–lacustrine material, calcareous, coarse–stratified fluvial material; level, horizontal fen	wet shrubby meadow	0.2% of KNP
VL6 Montane	as above, also Gleyed Regosol	calcareous, coarse–stratified fluvial material; level, horizontal fen	wet spruce, open forest	0.6% of KNP
WY2 (Wycliffe) Montane	Orthic Eutric Brunisol, Orthic Humic Regosol Rego Dark Brown	calcareous, variably textured drift material; calcareous, medium and fine textured tills; inclined, hummocky & ridged, gullied	Northerly: Douglas fir forest Southerly: Douglas fir open forest, dry grasslands	0.2% of KNP only ecosite where Chernozemic soils occur

3.1 CLIMATE AND AIR QUALITY

3.1.1 Description (Walker and Achuff 1984)

Kootenay National Park has a continental macroclimate, characterized by brief, cool summers and long, snowy winters (Janz and Storr 1977). The mountain topography results in considerable climatic variation throughout the area, with temperatures generally decreasing as altitude increases. Conversely, precipitation generally increases as altitude increases, with areas west of the Continental Divide in Kootenay National Park being moister than areas to the east, in Banff National Park. In general, Kootenay National Park, partly due to the blocking of Arctic air masses from the east by the Continental Divide, experiences milder temperatures than the Rocky Mountain areas east of the Divide.

The Montane ecoregion is the warmest and driest in Kootenay National Park, and contains much of the Kootenay Parkway (from Radium to Vermilion Crossing) and all of Settler's Road (Figure 7). Mean annual precipitation ranges from less than 300 to more than 600 mm, with maximum precipitation in summer, a secondary peak in winter and a minimum in late winter/early spring (March or April). Snowfall usually contributes 30–45% of total precipitation. Unlike Montane areas to the east of the Continental Divide, the Montane in Kootenay National Park is not frequently snowfree.

In the higher elevations north of Vermilion Crossing, the Kootenay Parkway traverses the Lower Subalpine. Temperatures are generally cooler than in the Montane, and precipitation is greater. April snow depths are about 30 cm deeper west of the Continental Divide than at sites at the same elevation to the east. Table 11 provides information about snow depths for stations in and near Kootenay National Park.Air quality is generally good in Kootenay National Park, although vehicle exhaust causes some localized deterioration near traffic areas. Burning of logging slash, forest fires and campfires contributes to high suspended particulate levels in some instances.

Table 11: Snow depths for Stations in and Near Kootenay National Park (Inventory and Engineering Branch, 1980 in Achuff et al 1984).

STATION AND ELEVATION	mean snow depth (cm) MARCH 1	APRIL 1	MAY 1
Sinclair Pass (1370 m)	62	52	19
Marble Canyon (1520 m)	128	126	94
Vermilion River #3 (1570m)	111	105	72
Vermilion River #5 (1570 m)	104	99	76
Vermilion River #2 (1610 m)	136	111	68
Vermilion River #1 (1680 m)	138	129	87
Vermilion River #4 (1680 m)	113	111	80
Floe Lake (2090 m)	211	232	210
Mt. Assiniboine (2230 m)	161	181	175

3.1.2 Significance and Implications

Climatic conditions strongly affect the management of Kootenay National Park's roads. First, the changing seasons result in concentrations of visitor activity during the summer months, with accompanying congestion on park roads and at park facilities.

The occurrence of snow during the winter months limits ungulate range. Wildlife, especially elk, concentrates in low elevation areas where snow depths are shallow. These areas are often the open, grassy road rights-of-way which create a vehicle/wildlife collision hazard. (See Section 3.6, Wildlife.)

Road maintenance activities are closely tied to climatic conditions. Of special environmental concern is the use of deicing compounds to maintain a bare and dry driving surface. These deicing compounds attract wildlife to the pavement, resulting in a number of ungulate/vehicle collisions each year.

As traffic increases, particularly large vehicles, exhaust emissions will also increase. Air quality concerns are likely to increase, particularly during inversion conditions. These would occur more often during times when cool air resides at lower elevations, such as on fall mornings, and on days when cold air stagnates in the park under high pressure situations (Goos 1990). Although not likely to be a significant impact to Kootenay National Park resources, localized air pollution along the Parkway will detract from enjoyment of the park by visitors close to the road — bicyclists, in particular.

Settler's Road is an unpaved secondary road where dust may be a problem, and is directly related to traffic volumes. Potential affects to vegetation caused by road dust have not been noted in this location, although a monitoring program should be initiated to ensure significant vegetation stress is not occurring. In other circumstances (Bermadinger et al, 1988), magnesite dust was found to have detrimental effects to spruce trees exposed to it. Therefore, at locations where tailings from the magnesite mine have been used as a substitute for standard borrow sources, special monitoring should be undertaken.

3.2 GEOLOGY AND GEOMORPHOLOGY

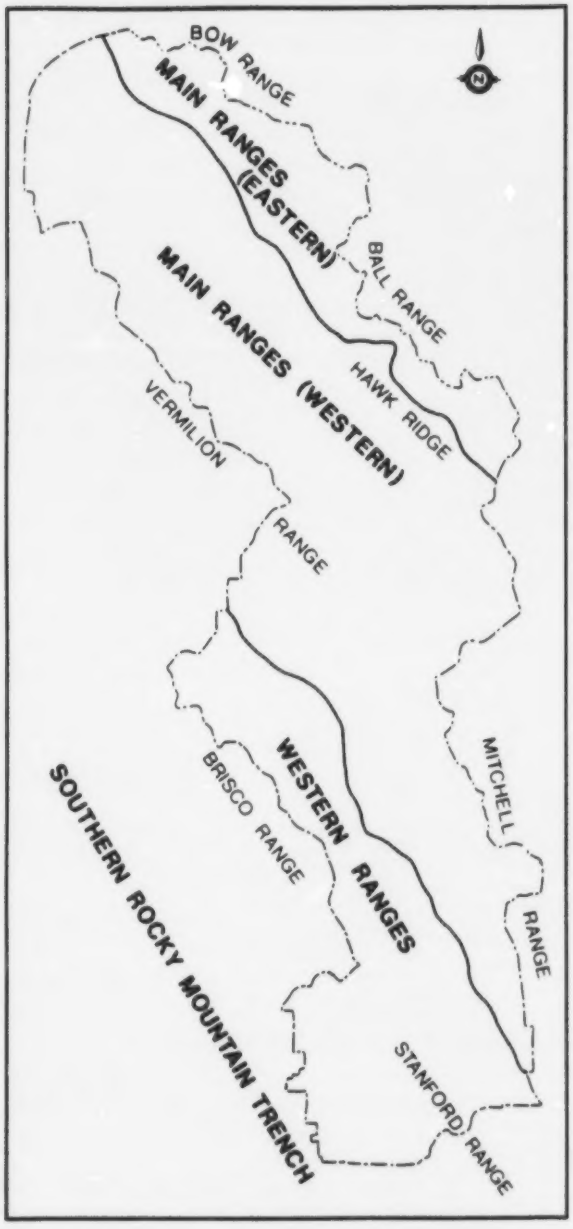
3.2.1 Description
(Walker et al 1984b; Taylor 1984)

Three ranges of the Rocky Mountains occur in Kootenay National Park: Eastern Main Ranges, Western Main Ranges and Western Ranges (Figure 8). Kootenay is the only national park containing a representation of the Western Ranges (eg. Stanford Range and Brisco Range), and therefore is considered an integral component of the Canadian Rocky Mountain Parks World Heritage Site (Canadian Parks Service 1983). The Kootenay Parkway passes through each of these ranges. Settler's Road parallels the division between the Western Ranges and the Western Main Ranges.

Along most of its length, Settler's Road passes over landscapes which are relatively flat (0–5% slope) (Achuff et al (eds.) 1984). Exceptions are near its crossing of Swede Creek and the intersection with the Parkway where slopes are typically 5–15%. The elevation of Settler's Road ranges from about 1130 m a.s.l. at its entry to the park, to its intersection with the Kootenay Parkway at approximately 1220 m.

The Parkway, on the other hand, experiences both extended flat sections and sections with steeper grades. It enters the park at Radium at approximately 1005 m, then crosses two passes (Sinclair Pass — 1465 m, and Vermilion Pass — 1267 m), before rising to approximately 1615 m where it crosses the Continental Divide into Banff.

Figure 8: Mountain Ranges, Kootenay National Park



The Parkway and Settler's Road occur primarily on landforms characterized by morainal till and ice contact stratified drift material. In some limited locations, alluvial and colluvial deposits occur.

Sinclair Canyon is an interesting example of erosional processes affecting road location. At the south end of the Parkway, Sinclair Creek has incised a narrow canyon through which the road passes, making a marked transition from the Rocky Mountains to the Rocky Mountain Trench.

3.2.2 Significance and Implications

Reflecting the nature of the landforms, the Parkway has relatively long flat stretches, interspersed with more steeply graded sections. This circumstance creates a road where traffic does not travel at a uniform rate of speed, and heavier or less powerful vehicles travel slower than passenger vehicles. The steep and long grades along Sinclair Creek also create difficult driving conditions, especially for loaded trucks or during slippery road conditions.

Because of the nature of much of the surficial deposits which underlie the road surfaces, the landform generally has a good capability to support road construction. Drainage is good; slopes are stable.

Past highway construction has significantly impacted the landforms of Kootenay National Park. The development of cuts and fills for roadbed construction and the creation of borrow pits has created a legacy of terrain impacts. The *Biophysical Inventory* (Achuff et al 1984) maps the 16 largest sites with a total area of 141.1 ha which have been used for material borrow. Many more smaller pits were not included in the *Biophysical Inventory*. Settler's Pit continues to be harvested and is used for ongoing maintenance of the Kootenay Parkway and Settler's Road. Aggregate requirements for winter abrasive have been reduced because of more effi-

cient crushing operation which eliminates large amounts of wasted material (Slovak, K. pers. comm). Environmental impacts from past and continuing borrow pit use could be partially mitigated by rehabilitating old borrow pits.

Increasing commercial traffic on the Kootenay Parkway is not expected to require major reconstruction although it intensifies the need to widen the road to provide more passing lanes and intersection upgrading (Hammer 1989, Morrall 1989). The Parkway currently requires resurfacing and strengthening in many areas. Increasing commercial traffic will probably require upgrading of Settler's Road and development/enlargement of borrow pits for road upgrading will likely be contemplated.

Although construction costs would be significantly increased, any additional material for road construction/upgrading should be sourced outside the National Park to prevent further impacts to the park's natural environment. Terrain restructuring beyond the existing disturbed areas should be avoided. Where circumstances require that material be sourced from within the park, thorough rehabilitation of borrow sites must be required.

3.3 SOILS

3.3.1 Description (Walker et al 1984b)

In Kootenay National Park, the wide variety of environmental circumstances has lead to the development of a number of soil orders.

Brunisolic soils are characteristic of the ecosites traversed by the Parkway and Settler's Road. For the most part, they are well to moderately well drained and present few difficulties in road construction. Their development indicates long–term landform stability and they have generally developed from calcareous parent materials.

In instances where landform instability has prevented the development of a full soil profile, Brunisolic soils are associated with Regosolic soils. Ecosites along the Parkway in Sinclair Creek valley are of this type. These soils are usually rapidly to moderately well drained.

In contrast, some sections of the roads do traverse imperfectly to very poorly drained soil types. Settler's Road and the Parkway near their junction cross ecosites which characteristically have Organic and Gleysolic soils, both indicative of development under saturated conditions. A similar situation occurs south of Vermilion Crossing where the Parkway traverses Organic, Gleyed Podzolic and Gleysolic soils.

3.3.2 Significance and Implications

Soils traversed by the Kootenay Parkway and Settler's Road are generally well to moderately well drained, and are stable. They are generally well–suited to development. In some limited instances, characteristically wet soils present greater development difficulty than drier soils, and disturbance to them should be minimized.

In places, soils which are highly calcareous, stoney or shallow will retard rehabilitation following disturbance.

Fuel spills and accidents involving toxic substances from commercial transport have caused, and will continue to cause, soil contamination. Fortunately, most commercial hauling through Kootenay National Park involves magnesite, iron calcine, gypsum, and forest products which have minimal soil contamination implications. When hazardous materials are transported, however, diligence in prevention of spills and immediate clean–up will minimize potential impacts. (Also see Section 3.4.2.) Contingency plans should be developed to ensure an efficient and correct response in the event of an incident.

Road salt (NaCl) used for winter maintenance likely results in soil contamination, although the

extent of the situation is unknown. The retention of sodium and chloride in soils varies with soil characteristics (Gidley 1990). Typically, salt lessens aeration and water availability in soils through structural change (Na replaces Ca) (Jones et al, 1986). The effects of road salt are often cumulative and therefore require lengthy studies to determine the significance of impact (Sypher: Mueller International Inc. 1987). Although from an environmental perspective road salting should be discontinued, the obligation to safely maintain the road surface and the absence of low cost alternatives has resulted in its continuing use. (Also see Section 3.4.2).

3.4 HYDROLOGY

3.4.1 Description (Walker et al 1984a)

Kootenay National Park occurs within the Columbia River Basin with most of the park being drained via the Kootenay River. The southwestern corner drains directly into the Columbia River, primarily via Sinclair and Stoddart Creeks. A small area in the northwestern corner of the park drains north through the Ottertail River into Yoho National Park.

Discharge volumes in streams and rivers in Kootenay National Park have significant seasonal variations. Table 12 illustrates the wide variability of flow which the Kootenay River and Vermilion River experience throughout the year. January flow in the Kootenay River, for example, is less than 2% of the average June flow.

The Parkway and Settler's Road follow the valleys of the park's major drainages, frequently crossing tributary streams which feed the rivers.

A number of hydrological features are of special value to the park. Radium Hot Springs at Sinclair Canyon is one of the most important visitor attractions and tourist destinations in the Columbia Valley. The Ochre beds just south of Marble Canyon are also popular visitor attractions both to modern–day visitors and to early Natives who used the ochre. Canyons carved by stream erosion — Marble Canyon and Sinclair Canyon, for example — are awe–inspiring and demonstrate an important natural process.

Glacial influence on stream discharge and water quality is strongest in the Vermilion River system. The river's milky appearance is a result of high loads of rock flour which contrasts sharply with the clear waters of the Kootenay River where the two streams join.

Water quality is of special interest in some circumstances in Kootenay National Park. Arsenic levels are relatively high in the Radium Hot Springs and other springs along Sinclair Creek. Sinclair Creek downstream of the hot springs

Table 12: Monthly Mean Stream Discharge, Vermilion River at Radium and Kootenay River at Kootenay Crossing (m^3/sec).
(Inland Waters Directorate 1988)

Month	Kootenay River (Kootenay Crossing)	Vermilion River (Radium)
January	0.33	3.73
February	0.22	3.18
March	0.18	3.04
April	1.08	5.29
May	12.00	37.90
June	19.90	72.70
July	12.40	61.30
August	5.11	32.60
September	3.22	18.90
October	1.97	12.00
November	0.99	8.21
December	0.57	5.27
Annual Mean	**4.97**	**21.70**

exceeds acceptable arsenic levels of drinking water (Gummer and Block 1979). The Radium Hot Springs are particularly attractive to visitors because they lack the strong sulphurous odour commonly associated with other hot springs.

3.4.2 Significance and Implications

Highway development in Kootenay National Park conflicts with the hydrological resources of the park in two important ways: the need to control alluvial processes at highway/stream crossings and pollution of water quality through highway run–off or spills.

Bridges typically require containment of the stream bed, and ongoing manipulation of normally evolving stream processes such as material deposition. These maintenance activities should be examined on a site–specific and ongoing basis to ensure they are conducted in the most environmentally appropriate way. Increased levels of traffic are not likely to require changes to the existing highway/stream interfaces in the park.

Water quality is affected by highway use. Fuel residues, highway maintenance materials (salt and sand), dust and inadvertent spills can all contribute to deterioration of water quality.

De-icing agents, most commonly salt (sodium chloride), are required to meet highway maintenance standards of bare pavement. In Kootenay National Park, to maintain the 94 km Kootenay Parkway, the following quantities of salt have been used (Slovak, pers. comm.):

1987/88 - 600 tonnes

1988/89 - 650 tonnes

1989/90 - 875 tonnes

1990/91 - 715 tonnes

The salt is either applied directly to the highway surface or mixed with the abrasives stockpile to keep the material workable in cold weather. Calcium chloride is also used on the Kootenay Parkway in more limited amounts for ice control.

Road salting has been known to cause contamination of underground aquifers, domestic wells (Fromm 1984; Pollock 1990) and can result in elevated chloride concentrations in streams draining salted highways for at least 6 months after application (Demers and Sage 1990). In severe instances where run-off into a lake or pond contains large amounts of chloride, the increased density of inflowing water may prevent or delay normal seasonal "turn over" due to build up of dense saline layers at the bottom. This may result in fish kills and die off of benthic invertebrates due to prolonged anaerobic condition of the hypolimnion (Harker 1988).

No data is available which monitors salt concentrations from highway run-off in Kootenay National Park, so the severity of impact from this source is unknown.

Representatives of the trucking industry report that they do not require a bare pavement standard in winter and, except in specific locations, would find snow-covered roads acceptable.

A number of techniques can be used to reduce the impacts related to salt contamination. Changing winter road maintenance standards to accept snow covered pavement would reduce or eliminate the need to use deicing agents, but the attendant traffic safety problems would be an issue. Reducing salt use by selective application and accurate calibration of highway maintenance equipment would also reduce impacts. Alternative chemicals — calcium chloride or calcium magnesium acetate (CMA) — have less environmental impact and are as effective as salt. Road maintenance budgets currently preclude the use of these more costly alternatives, however.

Spills occurring as a result of traffic mishaps are of serious concern. Although spills of magnesite ore, gypsum, iron calcine and forest products, commodities shipped in significant quantities on the Parkway, are not of special concern because of the low toxicity of the materials, spills of other materials — industrial acids, liquid asphalt and petroleum products, for example — are problematic. One large spill could seriously impact a large proportion of Kootenay's water resource. Potentially increasing traffic volume, the proximity of the river to the highway, and the numerous creek crossings, increase the risk of water contamination.

Options which could reduce potential damage resulting from spills of these materials are:

1) increased emphasis on safety inspection of commercial vehicles, including leaking gas tanks, lubricant and other fluid leakage. (Annual vehicle checks of commercial vehicles on other National Park roads reveal that approximately 10% of trucks fail to meet minimum safety standards (J. Turnbull, pers. comm.)

2) require carriers of hazardous goods to use alternate transportation routes (eg. Trans Canada Highway)

3) permit transport of hazardous materials through the park only when road conditions are optimal for safe vehicle operation

4) ensure that response plans, equipment and trained staff are available to deal quickly with spills.

3.5 VEGETATION

3.5.1 Description (Achuff and Dudynsky 1984)

Achuff et al (eds.) (1984) list 677 vascular taxa, 133 moss taxa, and 156 lichen taxa in Kootenay National Park. Three different ecoregions are identified in the park: Montane, Subalpine (Lower and Upper) and Alpine. The Kootenay Parkway and Settler's Road pass through the Montane and Lower Subalpine ecoregions.

The Montane Ecoregion occurs at the park's lower elevations. All of Settler's Road and the Parkway from Radium to north of Vermilion Crossing occurs in the Montane. This ecoregion is characterized by vegetation types dominated by Douglas fir *(Pseudotsuga menziesii)*, white spruce *(Picea glauca)*, trembling aspen *(Populus tremuloides)*, lodgepole pine *(Pinus contorta)* and by grasslands.

North of Vermilion Crossing, the Parkway travels through the Lower Subalpine. The vegetation of this ecoregion is characterized by closed coniferous forests consisting of lodgepole pine where fire has occurred, or Engelmann spruce *(Picea engelmanni)* where forests are successionally mature. Subalpine fir *(Abies lasiocarpa)* is also a common forest constituent in these areas.

The largest road accessible recently burned forest in the Canadian mountain parks occurs at the north end of the Kootenay Parkway. It provides an exceptional opportunity for park visitors to see a subalpine forest during its early stages of succession. A number of pull–offs and interpretive facilities and trails have been developed to encourage visitors to stop and learn about the process of forest succession.

3.5.2 Significance and Implications

The Kootenay Parkway and Settler's road have significantly affected the park's vegetation. Approximately 590 ha were cleared for the construction of the Kootenay Parkway and at least 141 ha were cleared for borrow pits. Much of this has regrown, with the road right–of–way comprising the bulk of grassland vegetation in Kootenay National Park. This grassland complex is composed of a mixture of agronomic (non–native) grasses dominated by red fescue *(Festuca rubra)*, smooth brome *(Bromus inermis)* and Kentucky bluegrass *(Poa pratensis)* (Poll 1989). This has created attractive wildlife habitat which is used extensively by elk. Natural vegetative succession and recolonization and decades of fire suppression for park management purposes have contributed to the relative scarcity of natural grasslands in Kootenay National Park.

Roads require continuing manipulation of the park's vegetation. Roadside clearing is required to provide a sufficient line of sight for drivers. Increasing commercial traffic intensifies the need to maintain the Kootenay Parkway as a major "highway" compared to a "Parkway" intended primarily for park enjoyment and access to park facilities.

Some upgrading of the Kootenay Parkway is anticipated. Construction of passing lanes and upgrading of intersections will increase the paved area in the park, destroying vegetation in the right–of–way and may, in places, intrude on previously undisturbed areas. Rehabilitation of old borrow areas and other disturbed sites would help mitigate existing impacts which resulted from the initial construction and subsequent upgrading and maintenance of the road. Where possible, native species should be used for rehabilitation.

A number of plant species have been identified as significant in Kootenay National Park, some because they are rare or have a restricted distribution, others because they are at the limit of their range. One species, western larch *(Larix occidentalis)* occurs as scattered individual trees and small groves along Sinclair Creek to Sinclair Pass, along Swede Creek and in the Kootenay Valley from the south boundary of the park along Settler's Road north to Kootenay Crossing. Any road expansion required to accommodate heavier traffic could further threaten these, or other significant species.

Winter maintenance of the Kootenay Parkway includes application of salt. Road salt affects vegetation in a number of ways. Uptake through roots occurs when salt is deposited in the soil by either direct placement (eg. plowing of contaminated snow onto roadsides), or by absorption of salt run-off. Salt deposition onto plant surfaces occurs through aerosol spray which can extend as much as 100 m from the road (Demers and Sage 1990) or airborne salt up to 500 m from the road, depending on topography, winds and vegetation density (Jones et al. 1990). Susceptibility to salt varies significantly among species (Leiser and John 1990). Although not specifically noted along the Kootenay Parkway, vegetation distress due to salting has been documented elsewhere along National Park highways (Westhaver 1987). Long term monitoring is required to determine the significance of this impact.

Other winter maintenance activities include sanding and snowplowing. Both can cause physical change to vegetation. Sanding smothers vegetation as it builds up over the years, and snowplows either directly damage vegetation through blade strikes or by pushing snow into forested areas. This is of special concern along Settler's Road where trees are adjacent to the road and is related to the need to maintain Settler's Road during the winter for commercial traffic.

Dust caused by traffic on Settler's Road has the potential to affect vegetation — either by reducing the amount of light penetration into the leaf, causing deleterious physiochemical effects, or by causing leaf surface damage (Bermadinger et al. 1988). This potential impact is directly related to the amount of commercial traffic on Settler's Road.

3.6 WILDLIFE

3.6.1 Description

The *Ecological Land Classification Vol. II* (Poll and Porter 1984) provides a general description of wildlife in Kootenay National Park:

> *One of the most spectacular and observable features of the fauna of KNP is the six species of ungulates. Their occurrence in the park is due to the variety of habitats and the protection afforded by the National Parks Act. Although most of the vegetated portion of the park is used by ungulates in summer, most species are severely restricted or forced to leave the park in winter due to high snow accumulations. Moose and mountain goat are year–round residents. Some elk and most mule deer move out of the park in winter, with those remaining restricted to Montane valley bottoms or steep southerly slopes in the Sinclair drainage. Most bighorn sheep winter on south and west aspects above the Columbia River outside the present park boundary. White–tailed deer leave the park entirely most winters, moving south into the Kootenay Valley or east to the Columbia Valley.*
>
> *The variety of ungulates and small mammals sustains a wide diversity of carnivores. However, only coyotes and marten are widespread and common. Wolves have been historically rare in KNP, however, during winter 1982–83, at least eight wolves wintered in the Kootenay Valley. Lynx are widespread but uncommon, while bobcats are very rare and confined to the southern portion of the Kootenay Valley. Cougars are rare, occurring mainly in the south–western portions of the park. A wide variety of Mustelidae (weasels) occurs in the park, however, only marten and short–tailed weasels are common. Long–tailed weasels are uncommon and mink are very rare. Fishers and otters are rare. Wolverines are widespread, but uncommon. Badgers and striped skunks are known only from lower Sinclair Creek and are very rare.*
>
> *Black bears are common at low elevations in the Kootenay and lower Vermilion River Valleys. Grizzlies are uncommon and occur generally at higher elevations, primarily in the upper Vermilion and upper Sinclair watersheds.*
>
> *Thirty–two other species of mammals occur or have occurred in KNP. The four species of shrews are uncommon, and water and pigmy shrews are rare. Seven species of bats have been recorded. All are rare or uncommon. Lagomorphs are represented by pika and snowshoe hare. Pikas are relatively uncommon while snowshoe hares are widespread and common in closed coniferous forests from Montane to Upper Subalpine. The Order Rodentia contains the remaining 18 species, of which red–backed vole, deer mouse, red squirrel and Columbian ground squirrel are most common.*
>
> *At least 191 species of birds occur in KNP. Of these, 32 are permanent residents of the park; the rest migrate each winter to areas where weather is less severe.*

Bird densities are low at all seasons in the prevalent coniferous forest vegetation which provides little habitat stratification or forage. Nonetheless, there are limited areas with high species densities. These include wetlands and vegetation mosaics along Montane streams and lakeshores, the diverse mixed forest of the Kootenay Valley, and the bases of snow avalanche slopes.

Waterfowl and shorebirds are scarce during the breeding season, due to the scarcity of ponds and lakes. Although KNP is not on a major migration flyway, all of the ponds and lakes are used by migrants. In a park context, certain ponds and wetlands (eg. Dog Lake, Daer Pond and Kootenay Ponds) are highly important to breeding and migratory birds due to their well developed shoreline vegetation.

Raptors and owls are less common in KNP than in the adjacent Columbia Valley. Most records are from Montane parts of the Kootenay and Columbia valleys. Mixed forests near McLeod Meadows and Dolly Varden Creek are important to Red–tailed Hawk, American Kestrel, Great Gray Owl, Northern Pygmy–Owl and Boreal Owl. Six species of owls probably breed in KNP, with Boreal Owl one of the commonest. . . .

Four amphibians and three reptile species have been recorded in KNP. Wood frogs, spotted frogs and western toads breed in Montane and Lower Subalpine ponds. Long–toed salamanders are limited to Montane ponds of the Kootenay Valley. Three species of snake occur infrequently; the Sinclair Canyon area provides rocky bluffs where they are most often seen. Only the western toad ranges throughout the park at most elevations.

A limnological survey of the streams in Kootenay National Park (Alger and Donald 1984) found a variety of fish species in streams which contact the Kootenay Parkway and Settler's Road. Bull trout *(Salvelinus confluentus)* was the most widespread, although cutthroat trout *(Salmo clarki)*, rainbow trout *(Salmo gairdneri)*, brook trout *(Salvelinus fontinalis)*, mountain whitefish *(Prosopium williamsoni)*, and slimy sculpin *(Corrus cognatus)* were also commonly observed (Table 13). Of these, bull trout, whitefish, slimy sculpin and a subspecies of cutthroat *(Salmo clarki lewisi)* are native; the others have been introduced to improve the sport fishery of park waters. Of special interest are Kokanee salmon *(Oncorhynchus nerka)* which run up the Kootenay River to spawn in the Simpson and Vermilion rivers (B. Sheehan, pers. comm.). In general, low nutrient levels and low temperatures of park streams result in slow growth. The upper Kootenay River exhibited the highest growth rate, and Alger and Donald (1984) attributed this to the occurrence of run off from shallow lakes and ponds rather than glacial run off.

a) Wildlife Habitats Along the Kootenay Parkway and Settler's Road

Poll (1989) provides a description of the seasonal distribution of ungulate use along the Kootenay Parkway:

> *Elk use of the Parkway corridor and seeded right–of–way is greatest in the post–rut period (October to December) and in spring (March to May). The duration of use of the grassy right–of–way, in both seasons, is primarily dependent on snow depth and crusting conditions. Winter use declines in late December and early January; the period when snow depth along the right–of–way normally exceeds 50 cm and/or crusting conditions prevent efficient foraging. The timing of spring use is dependent on the snow–melt.*

Table 13: Fish Species Present in Streams Crossed by the Kootenay Parkway and Settler's Road, Kootenay National Park (Alger and Donald 1984)

STREAM	Brook Trout	Bull Trout	Cutthroat Trout	Rainbow Trout	Mountain Whitefish	Slimy Sculpin
Dolly Varden Creek		x	x		x	x
John McKay Creek	x					
Haffner Creek		x				
Hawk Creek		x				
Kootenay River	x	x	x	x	x	x
Meadow Creek	x		x	x		
Minnow Creek			none			
Vermilion River		x	x		x	x
Wardle Creek			none			

brook trout .....*Salvelinus fontinalis*
cutthroat trout .....*Salmo clarki*
mountain whitefish .....*Propsopium williamsoni*
bull trout.....*Salveiinus confluentis*
rainbow trout.....*Salmo gairdneri*
slimy sculpin .....*Cottus cognatus*

Roadside use by elk is least from June to September and January to April. Key areas of elk utilization during high use periods are Nixon Creek fan, Meadow Creek fan (McLeod Meadows), Crook's Meadow – Dolly Varden Creek and Kootenay Crossing meadows. Key areas in the Vermilion Valley include Wardle Flats, Vermilion Crossing, Floe and Hawk creeks and Numa flats.

White–tailed deer use of the Parkway corridor and the Kootenay and Vermilion valleys is primarily limited to the snow–free months (May to October). A northward movement of white–tailed deer from winter ranges to the south and west of the park, occurs in the Kootenay and Vermilion valleys during May and June. The largest counts of white–tailed deer along the Parkway are obtained during this period. Numbers of white–tailed deer decline sharply in early fall and in most years white–tailed deer have left the Kootenay and Vermilion valleys by late October or early November. Key white–tailed deer summer areas within the corridor are in the Settler's Road – Parkway junction area, Nixon Creek, Crook's Meadow–Dolly Varden Creek, and between the Daer Fire road and Kootenay Crossing. White–tailed deer use of the Vermilion valley is low, however, the Floe and Hawk creeks fans are of particular importance. Mule deer are less common in the corridor than either elk or white–tailed deer. Similar to white–tailed deer, however, mule deer utilize the Kootenay and Vermilion valleys only during the snow–free period; wintering primarily in the lower Sinclair Creek drainage and the Columbia Valley. Unlike white–tailed deer, mule deer are not restricted to the riparian habitats along the valley bottoms of the Kootenay and Vermilion rivers, rather preferring to summer in subalpine and alpine areas.

In addition to elk, mule deer and white–tailed deer, other ungulates common to the Parkway area are mountain goats, bighorn sheep and moose. Mountain goats are frequently observed at the base of Mount Wardle where a lick is located.

Bighorn sheep inhabit the Sinclair Creek to Stoddart Creek area of the park and are commonly seen near the Aquacourts.

Moose are seen infrequently, and observations are usually associated with licks: one on the roadside between Settler's Road and Nixon Creek, and the other on the roadside between Wardle Creek and the Simpson–Vermilion River junction.

Roadsides are also attractive to a number of carnivores. Availability of prey, carrion and high quality forage (eg. dandelions and berries) attract coyotes, wolves and black bears to the right of way.

3.6.2 Significance and Implications

Wildlife is affected in a number of ways by the Kootenay Parkway. Removal and alienation of habitat, and creation of artificial habitat has resulted from paving and right-of-way clearing. Other major conflicts between wildlife and the traffic on the Parkway are collisions between vehicles and wildlife, and pollution of aquatic environments through highway maintenance and spills.

a) Wildlife Mortality

Wildlife Mortality Volume

The greatest conflict between traffic on the Kootenay Parkway and wildlife results from wildlife/vehicle encounters. Large ungulates in particular are subject to high mortality on the Parkway.

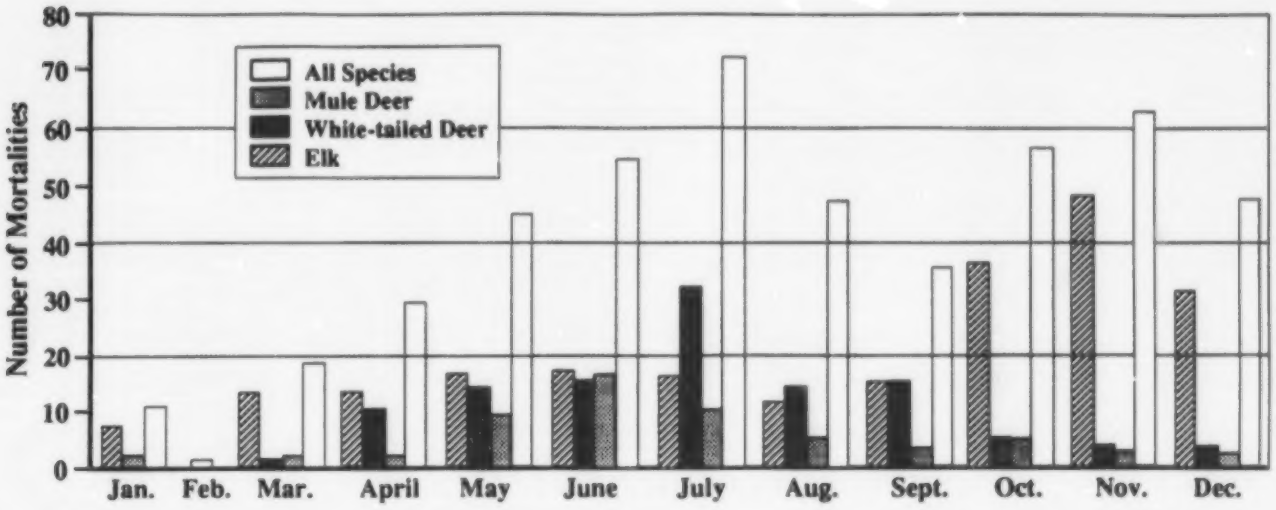
Table 14 provides a summary of mortality of seven species of wildlife on the Kootenay Parkway. During the most recent decade, 1981-1990, 36% (188) of road kills were elk, 13% (66) were mule deer, 30% (148) were white-tailed deer, 5% (27) were bighorn sheep, 6% (29) were moose, 2% (12) were black bear, and coyote comprised the remaining 6% (30).

Seasonal Distribution of Mortality

Poll (1989) noted a marked seasonal distribution in each species' vehicle-caused mortality. Elk are least susceptible during the late winter (January – February), with relatively even mortality from spring (March) through to fall (September). Heaviest mortality is experienced by elk during the late fall and early winter (October, November and December) (Figure 9).

Both species of deer experience heaviest mortality during the summer (Figure 9). Moose mortality is highest in July, with no deaths being recorded in late winter to early summer (February to June). Bighorn sheep mortality does not display a clear trend, although no deaths have been recorded in January and February.

Figure 9: Kootenay Parkway - Wildlife Mortality by Month for 1978-1987. (after Poll, 1989)



Diurnal Distribution of Mortality

Limited data is available which relates time of day to wildlife/vehicle collisions. Poll (1989) determined that 44.2% of known wildlife mortalities on the Kootenay Parkway occurred between 0600 and 1200; 27.9% occurred between 1800 and 2400 hours (Figure 10). Time periods of especially high mortality were in the early morning (0400–0900) and evenings (1800–2300).

Heaviest use of the right–of–way by elk and deer occurred in the evening and early morning. Although heavier day time traffic volumes may deter elk from using the right–of–way, they appear little affected by moving traffic after sunset (Poll, 1989).

Figure 10: Kootenay Parkway Wildlife Mortality % by Time of Day

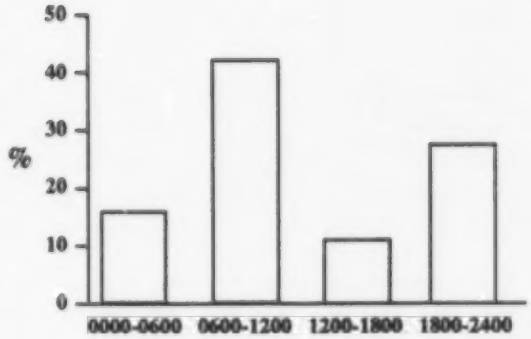


Table 14: Wildlife Mortality on the Kootenay Parkway, Kootenay National Park, 1950 –1988
(1950–1977 from Enderwick 1981; 1978–1981 from Sheehan 1986;
1982–1987 from Poll 1989; 1988-1990 from Kootenay Warden Service)

YEAR	Elk	Mule Deer	White Tailed Deer	Bighorn Sheep	Moose	Black Bear	Coyote	Total
1950	3	1	-	-	-	-	-	4
1951	1	-	-	-	-	-	-	1
1956	1	1	-	-	-	-	3	5
1958	-	-	-	-	-	2	1	3
1959	-	-	-	-	-	2	-	2
1963	-	-	-	-	-	1	-	1
1964	-	-	-	-	-	-	1	1
1965	-	-	1	-	-	1	-	2
1967	2	-	-	-	-	-	1	3
1968	8	1	2	-	1	1	4	17
1969	4	2	2	-	1	2	3	14
1970	9	3	3	-	-	1	-	16
1971	5	2	1	-	-	-	1	9
1972	4	3	-	-	-	-	-	7
1973	5	3	-	-	-	2	2	12
1974	3	4	1	-	-	2	1	11
1975	7	4	2	1	1	1	1	17
1976	6	6	3	2	2	4	-	23
1977	9	2	3	1	1	1	1	18
1978	19	7	4	4	3	1	-	38
1979	15	5	9	1	1	-	1	32
1980	25	11	15	4	1	1	3	60
1981	29	4	10	2	2		2	49
1982	22	2	7	2	-	3	-	36
1983	25	4	5	3	1	-	4	42
1984	14	7	8	1	2	4	2	38
1985	24	8	11	2	3	-	1	49
1986	28	7	21	4	3	1	4	68
1987	18	5	24	1	4	2	4	58
1988	17	14	23	5	5	0	8	72
1989	4	9	15	7	1	0	4	40
1990	7	6	24	0	8	2	1	48
Total (1981-1990)	**188**	**66**	**148**	**27**	**29**	**12**	**30**	**500**
%	**36 %**	**13 %**	**30 %**	**5 %**	**6 %**	**2 %**	**6 %**	

Vehicle Types Implicated in Wildlife Mortality

Poll (1989) investigated the type of vehicle involved in Parkway wildlife mortalities. For more than 50% of known mortalities, vehicle type was not determined. Of the vehicle types known, passenger vehicles (eg. cars, pickups) were involved in 32.3% of the accidents, transport class vehicles were involved in 17.2% of collisions (Figure 11).

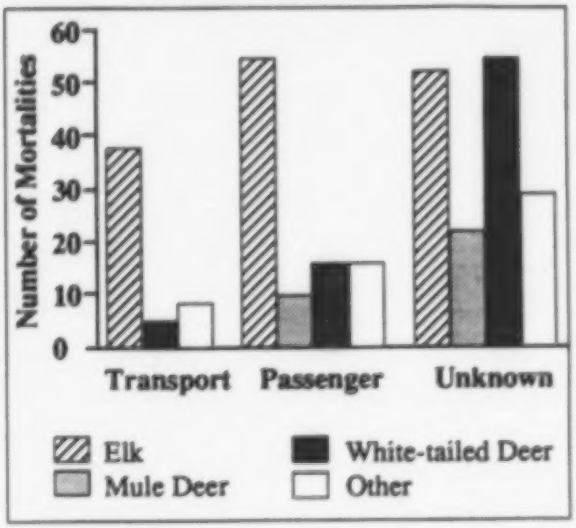
Vehicle collisions with larger wildlife were more likely to be reported. For example, vehicle types for 63.6% of elk collisions were known (25.9% transport class vehicles, 37.7% passenger class vehicles). With deer, only 30% of vehicle types were known. It appears that the greater damage incurred by a vehicle, the more likely the accident is to be reported.

This data, together with the time of day when most wildlife mortalities occur (ie. during early morning hours when the traffic mix consists of a high proportion of commercial trucks), suggests that commercial traffic is disproportionately responsible for wildlife mortality on the Kootenay Parkway (Poll 1989). This hypothesis is not consistent with data provided by major commercial users of the Kootenay Parkway and Settler's Road, however. In 1990, eight carriers with a combined total of 32,261 crossings of the Kootenay Parkway reported 6 incidents with wildlife (Stakeholders proposals, 1991).

Traffic Volume and Wildlife Mortality

The relationship between traffic volume and ungulate/vehicle collisions is not clear. On a daily basis, highest mortality usually occurred during times when ungulates were most active on the Parkway right–of–way (ie. morning and evening), but traffic volumes the lowest. The exception was Friday evenings when high traffic volumes were concurrent with high ungulate use of the right–of–way. At these times, increases in traffic volume coincided with higher ungulate mortality (Poll 1989).

Figure 11: Vehicle Types Implicated in Wildlife Mortality



Wildlife Mortality and Parkway Characteristics

Wildlife/vehicle collisions are concentrated at specific locations along the Kootenay Parkway. For elk, 62.6% of accidents occurred along 38.3% of the Parkway's length. White–tailed deer mortality was even more concentrated, with 80.6% being killed within 28.7% of the Parkway.

Poll (1989) determined that physical characteristics of the Parkway (eg. driver visibility, proportion of forested area adjacent to the Parkway right–of–way, presence of man–disturbed areas*) were better predictors of wildlife kill sites than either natural habitat or ungulate use characteristics. High ungulate kill sites occur at locations such as McLeod Meadows, Crook's Meadow – Dolly Varden, Kootenay Crossing, Vermilion Crossing and the Hawk–Floe creeks area, where disturbed sites occur on both sides of the Parkway. Ungulate movements between these sites make wildlife susceptible to vehicle collision when they cross the highway. Where driver visibility is reduced, kills also tended to be more frequent.

* disturbed site: borrow pits, man-made grasslands or park facilities. These sites frequently provide good feeding habitat for elk

Effects of Highway Maintenance on Ungulate Mortality

Poll (1989) observed that some highway maintenance practices worsened conditions leading to wildlife mortality on the Kootenay Parkway.

The use of sodium chloride (Na Cl) as a deicing salt attracts ungulates to the highway surface. Numerous observations of elk and bighorn sheep licking salt from the highway surface have been noted on the Kootenay Parkway. In one incident, Poll reported that large numbers of elk had been attracted to the pavement after a single salt (NaCl) application and during the following three or four days, when elk were concentrated at the site, three elk-vehicle accidents occurred.

Road maintenance practices which stimulate vegetation growth adjacent to the highway attract ungulates to the road surface. Ploughing back snowbanks at the Parkway margin stimulates early spring growth at the road edge. This new growth is highly attractive to elk when vegetation elsewhere is still dormant or snow covered. As well, mowing the right–of–way vegetation in late summer stimulates growth and attracts ungulates when vegetation elsewhere has matured.

Significance of Highway Mortality to Ungulate Populations

Based on the data available, Poll (1989) was able to provide a preliminary assessment of the significance of vehicle–caused wildlife mortality to ungulate populations in Kootenay National Park.

For bighorn sheep, the ten year average kill rate of less than 3% of the 1987 population was not considered to be a significant impact on the population because recruitment exceeds that required for population maintenance.

The rate of kill of both black bear and coyote is also believed to be below significant levels.

Insufficient information about moose population dynamics and habitat conditions within the park is available to determine the significance of vehicle–caused mortality to moose. Poll (1989) estimates mortality since 1985 to be almost 5% of the population, however, which may be a significant mortality factor.

Population sizes of both mule deer and white-tailed deer within the park are not known, however the number of deer killed annually on the Parkway suggests that mule deer numbers are relatively stable, and that the white–tailed deer population is increasing.

Elk comprise almost 50% of the wildlife mortality on the Parkway. This species is the most vulnerable to collisions, and is most impacted as a population. Elk in Kootenay forage extensively along the Parkway where the grassy right-of-way provides the quality and quantity of forage which is becoming less available elsewhere in the park. Poll (1989) advises that the current level of elk mortality on the Kootenay Parkway is contributing to declining numbers of elk, and any additional mortality could have serious implications for the continued survival of elk within the park.

b) Visitor Appreciation of Wildlife

Kootenay National Park is one of the best locations in North America for people to view wildlife in a natural setting. There are excellent opportunities for people to view and photograph most of North America's large mammals: elk, mountain goat, bighorn sheep, white–tailed deer and mule deer consistently; moose and bear occasionally. It is a visitor opportunity which contributes substantially to Kootenay's value as a National Park.

Increasing commercial truck traffic could negatively affect this park value in two ways — expected higher wildlife mortality could decrease the number of animals, and the heavier traffic may prevent motorists from spotting wildlife and discourage travellers from stopping to view it and take photos.

c) Amphibians

Because of the proximity of many of Kootenay National Park's waterbodies to the Kootenay Parkway, winter maintenance — salting — of the road surface has the potential to contaminate surface water. Elsewhere (ie. Banff National Park), management recommendations to reduce impacts to amphibians include minimizing salting on roads adjoining noted amphibian habitat (Holroyd and Van Tighem 1983). Highway maintenance standards which demand bare pavement apply regardless of traffic mix, although increased traffic levels intensify the demand to maintain this winter driving standard.

d) Fish

Commercial hauling has the potential to impact fish habitats because of the risk of spills of toxic materials. Previous spills — liquid asphalt and fuel oil, for example — have entered streams and have contaminated aquatic environments. Although the majority of commercial haulers through the park transport non–hazardous material (eg. lumber, magnesite ore) many still carry hazardous material such as petroleum products and industrial acids.

3.6.3 Potential Mitigating Measures

A number of measures could be taken to reduce the impact of commercial hauling on the Kootenay Parkway to wildlife populations and habitats in Kootenay National Park. Many of the recommendations presented below were suggested by Poll (1989) to reduce wildlife mortality from vehicle collisions.

a) Fencing

Fencing the right-of-way to prevent animal access is the most effective method of eliminating vehicle-caused wildlife mortality. Fencing has been highly effective on the TransCanada Highway in Banff National Park. It does, however, have high initial and long-term maintenance costs, and creates a serious negative impact to the aesthetic value of the Parkway. In Kootenay National Park, the Parkway right-of-way provides a significant amount of seasonally important forage, especially for elk, so restricting elk from using this habitat may create a forage deficit for existing populations. At this time, ungulate-vehicle mortality in Kootenay does not justify a Parkway fencing program.

b) Reflectors

Devices which create an "optical fence" by reflecting the headlights of approaching vehicles and deterring wildlife from crossing the road have had mixed success at other locations. They may be effective in reducing elk and deer mortality at night, and an experimental installation of these devices was initiated along the Kootenay Parkway in late 1989. Results on the Parkway are encouraging and an additional section of reflectors will be installed near McLeod Meadows in the summer of 1991 (Poll, pers. comm.)

c) Ultrasonic Warning Devices

Devices which are mounted on vehicles and emit sound have been proposed as effective in reducing some wildlife mortality. The effectiveness of these devices remains inconclusive (Bradford, 1989; Fox, 1991). In consultation with major Parkway users, a trial program should be established to determine if the devices are effective.

d) Driver Awareness

Driver reaction time to wildlife on the road surface is an important factor in a driver's ability to avoid a collision. Increasing driver awareness through signs (eg. elk silhouettes) may have some effect in reducing wildlife mortality. To prevent driver habituation, signs should only be activitated (eg. flashing lights) at sites and times where wildlife hazards are greatest.

A number of the industrial users of the Kootenay Parkway provide on-going educational programs which include information to make drivers aware of wildlife related hazards (Martin, 1991; Fraser, 1991; Fox, 1991).

e) Parkway Design and Maintenance

Visibility is a key factor influencing ungulate-vehicle collisions on the Kootenay Parkway. Poll (1989) concluded that improving roadside visibility, particularly at high-kill locations along the Parkway, could significantly reduce ungulate-vehicle collisions. Roadside visibility could be increased by reducing steepness of sideslopes, clearing shrubs from the right-of-way and removing guiderails where public safety considerations permit.

Deicing Salts — Sodium chloride (NaCl) is currently used as a deicing agent on the Parkway, where it attracts ungulates to the road surface. Replacing NaCl with chemicals less attractive to wildlife (calcium chloride, CMA), or changing Parkway maintenance standards to accept snow- or ice-covered pavement would reduce this environmental impact. The resulting poorer driving conditions would require that drivers adjust their expectations and driving behaviour to accommodate changed maintenance standards. Use of alternate chemicals is currently not acceptable because of the increased cost and limited maintenance budgets.

Roadside Mowing encourages new plant growth which attracts ungulates. Mowing should be minimized, and restricted to late in the season to avoid encouraging plant growth.

Plowing Beyond the Pavement Edge to remove snow from the road shoulders often exposes a strip along the road where elk can graze on new grass while forage elsewhere remains covered with snow. Refraining from this practice, or retaining a layer (15–20 cm) of snow would delay early green–up on these strips to more closely coincide with vegetation growth elsewhere.

f) Traffic Management – Vehicle Operating Restrictions

Speed is an important factor in stopping distance and the ability of a motorist to avoid colliding with an animal on the road surface. It is suspected that vehicles exceeding the posted speed limit are disproportionately responsible for wildlife mortality. Speeding vehicles require longer stopping distances and therefore, are more likely to be involved in ungulate collisions. As well, the average stopping distance of a tractor-trailer unit is significantly longer than a passenger car. At 90 kph, a loaded tractor-trailer unit requires from 60 to 113 m to stop (depending on brake temperature) compared to 40.5 m required by a passenger vehicle (Insurance Institute for Highway Safety, 1989). To achieve a high degree of success in reducing wildlife-vehicle collisions at night, speed control would be required to restrict speeds to enable a driver to stop within the range of headlights. Improved driver perception times achieved through public awareness programs and signing could also create an effective reduction of stopping distance.

Enforcing existing speed limits may reduce ungulate mortality.

Seasonal Operating Restrictions — Because ungulate mortality on the Kootenay Parkway is concentrated both seasonally and diurnally, vehicle operating restrictions during predictably high kill periods and at high risk locations could reduce wildlife mortality. Specifically:

- night time speed limit (maximum 70 kph) during periods and at specific locations where ungulates most actively use the right–of–way: June–July for deer and October – December for elk. To be effective, increased enforcement would be required to ensure compliance. The speed restriction could be augmented with an "early warning" signing system to increase driver alertness in high hazard locations.
- reduce traffic volumes during early morning and evening periods, when the majority of ungulate–vehicle accidents occur. Specifically, restricting truck traffic to daylight hours during October–December could reduce elk mortality on the Parkway and would have a minimal conflict with recreational and passenger vehicle traffic on the Kootenay Parkway. The commercial users of the Parkway are highly resistant to this restriction because of its serious economic effects to the industry.

g) Control of Movement of Hazardous Materials

Some materials hauled through the park — petrochemicals, industrial acids, for example — can damage aquatic environments if a spill occurs. Mitigation measures which could reduce this risk are:

- require that hazardous materials be shipped via alternate routes,
- limit transport of hazardous materials to times when good driving conditions prevail,
- enforce vehicle maintenance standards and speed limits, and
- develop contingency plans to deal quickly with spills to limit dispersal of material should a spill occur.

h) Vegetation Management

The Kootenay Parkway right-of-way provides critical forage for elk in the fall, early winter and spring. White-tailed deer are attracted to the "edge" habitats created by right-of-way clearing and other disturbed areas. Discouraging or preventing wildlife from using the Parkway right-of-way is an obvious solution to reducing ungulate susceptibility to vehicle collision. However, as suitable alternative habitat, especially for elk, is limited in the Kootenay Valley, preventing elk from feeding on the right-of-way could have serious implications for elk populations. Vegetation management — controlled burns to re-establish earlier successional stages of vegetation, for example — to provide habitat away from the Parkway may be an option for long-term reduction of elk/vehicle collisions and the maintenance of elk populations.

4.0 HUMAN USE OF THE NATURAL ENVIRONMENT

4.1 PUBLIC SAFETY

4.1.1 Description

Public safety is a major concern when providing opportunities for visitors to enjoy a National Park. Although avalanches, falls and drownings result in visitor injury and death, traffic accidents are the major hazard to park visitors. From January 1979 to March 1982, 167 accidents occurred on the Kootenay Parkway, for an accident rate of 1.01 accidents/ million vehicle km. (This compares with 1.26 for the Trans Canada Highway in Glacier National Park and 0.85 for the Trans Canada Highway in Yoho National Park.) This rate was considered acceptable when compared with comparable highways in the Province of British Columbia (Hammer 1989).

The Kootenay National Park Warden Service provides data on injury accidents in Table 15.

The Parkway width allows for 3.0 m wide paved shoulders along much of its length, allowing ample room for bicycle travellers except where passing lanes have been provided for motor vehicles .

Winter driving conditions prevail throughout a large part of the year. Winter storms and variable climatic circumstances occasionally cause treacherous driving conditions, resulting in highway closure 2–3 times a year (Sheehan, pers. comm.)

In some localized areas, the highway is affected by avalanche paths. Two major avalanche paths threaten the road — the Assiniboine slide path at Vermilion Crossing and the Mount Whymper slide path north of Marble Canyon. Occasionally, the highway is closed for avalanche control activities (Sheehan, pers. comm.)

Table 15: Public Safety Statistics for Injury Accidents in Kootenay National Park 1980–1985
(Warden Service, Kootenay National Park)

YEAR	TOTAL NUMBER OF INJURY ACCIDENTS	INJURY SEVERITY			ACCIDENTS INVOLVING		
		minor	major	fatal	animals	commercial vehicles	passenger vehicles
1980	23	8	23	5	9	2	12
1981	33	25	18	0	4	3	25
1982	18	12	10	1	4	0	14
1983	22	7	9	2	7	0	15
1984	22	16	7	1	0	4	18
1985	20	15	10	0	4	1	15
TOTALS	138	83	77	9	28	10	99

4.1.2 Significance and Implications

Trailer-truck trains, which comprise the bulk of the commercial traffic on the Kootenay Parkway, are of special concern in considering public saftey. Although heavy trucks account for only 6.3% of the average annual daily traffic (Morrall, 1989), accident severity is significantly greater than for passenger vehicle traffic. The Insurance Institute for Highway Safety (1989) reports that in fatal crashes involving passenger cars and tractor-trailers, the car occupants are killed 38 times as often as crashes where tractor-trailers are not involved. Of 4,472 deaths in tractor-trailer crashes, only 16% of them were truck occupants.

In KNP during the six year period (1980–1985), 138 injury accidents were reported. Of the 109 incidents where vehicle class was identified, commercial trucks accounted for 10 (9.2%) (Table 15). Truck traffic accounted for approximately 4.2% of total vehicles during the same period (Table 2).

The mix of commercial and recreational traffic on the Kootenay Parkway aggravates the hazard of driving. Motorhomes pulling onto the shoulder of the road to watch wildlife, cars crossing the highway to enter picnic sites, and bicycles travelling along the roadsides, are not compatible with heavy commercial traffic. To improve Parkway engineering safety standards, a program of intersection improvements and passing lane construction has been initiated (Hammer 1989, Morrall 1989). These highway changes are unlikely to reduce wildlife/vehicle incidents, however.

Statistics about incidents requiring an emergency response in Kootenay National Park between 1980 – 1985 are presented in Table 16. Commercial vehicles, which were approximately 4.2% of the traffic mix, were involved in about 26% of the vehicle–related incidents requiring an emergency response (eg. traffic accidents, spilled loads, etc.).

These data indicate that increasing the level of commercial trucking would increase public safety concerns along the Kootenay Parkway. Mitigating measures which may reduce this hazard are:

- increased law enforcement to reduce excessive speed,
- increased emphasis on safety inspection of commercial vehicles. (Annual vehicle checks

Table 16: Emergency Responses, Kootenay National Park, 1980– 1985
(Warden Service, Kootenay National Park

YEAR	VEHICLE–RELATED				WILDLIFE	SNOW/ROCK
	Commercial	Passenger	Other	Total		
1980	13 (16%)	65 (81%)	2 (2%)	80	27	7
1981	25 (22%)	64 (57%)	23 (21%)	112	56	10
1982	37 (35%)	61 (57%)	9 (8%)	107	42	0
1983	17 (30%)	34 (61%)	5 (9%)	56	37	7
1984	19 (26%)	43 (61%)	9 (13%)	71	36	3
1985	18 (24%)	48 (65%)	8 (11%)	74	51	4
Total	129 (26%)	315 (63%)	56 (11%)	500	249	3

of commercial vehicles on other national park roads reveal that approximately 10% of trucks failed to meet minimum safety standards (J. Turnbull, pers. comm.). Elsewhere, at least one-third of tractor-trailer units had defects enough to require putting them out of service. Units with mechanical defects were found to be more than twice as likely than those without defects to be involved in a crash (The Insurance Institute for Highway Safety 1989).

- permit commercial transport only when highway conditions are good, and
- upgrade highway design standards to improve intersections and provide passing lanes to improve safety for bicyclists and reduce driver frustration.

4.2 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

4.2.1 Description

Kootenay National Park has an interesting history, much of it tied to the unusual hydrology of the area (ochre beds and hot springs) and mountain passes. The Kootenay Indians were believed to have obtained ochre from the Paint Pots in the upper Vermilion valley and frequently used the hot springs in Sinclair Canyon. Mitchell and Choquette (1973) recorded a number of historic sites in Kootenay National Park. Sites include native campsites, rock painting in Sinclair Canyon and historic sites associated with early exploration and settlement by Europeans.

The Kootenay Valley was a major north–south travel corridor for native inhabitants, and east–west routes such as Whiteman Pass, Simpson Pass and Vermilion Pass were well known to them. For European travellers, however, the more northerly Athabasca Pass was the principal route until the 1850's. In August 1858, James Hector of the Palliser expedition was the first white man to travel over Vermilion Pass. Access to the Windermere area during early settlement was via Cranbrook or Golden until the development of the Kootenay Parkway (Poll et al 1984).

4.2.2 Significance and Implications

The original construction and subsequent upgrading of the Kootenay Parkway and Settler's Road damaged a number of historic and prehistoric sites. Increased commercial truck use of these roads will not cause further impacts. Proposed intersection improvements and passing lane additions will require site specific evaluation for cultural sites to determine the potential for impact and to identify mitigating measures.

4.3 AESTHETIC VALUES

4.3.1 Description

A National Park is intended to protect, unimpaired for future generations, representative features of Canadian landscape, and allow for the use, appreciation and enjoyment of that landscape by present generations. In addition to protecting the park's physical resources, management of a National Park must ensure that land uses do not diminish present or future park visitors' appreciation of the natural environment.

Visitors achieve an appreciation of that specially protected environment through their senses. Many things — sights, smells, sounds — influence their perception of that environment.

The most obvious aesthetic value of Kootenay National Park is its scenic beauty. The high public profile and value placed on this park by Canadians is due in large part to the high quality scenery and expanse of natural landscapes that it provides. Recognizing this beauty, the United Nations designated Kootenay National Park, along with Banff, Jasper and Yoho national parks, as a World Heritage Site.

One of the most popular ways that visitors enjoy Kootenay's scenery is driving. The Kootenay Parkway is especially conducive for this because it passes through a variety of landscapes, has a number of open, scenic vistas, parallels interesting rivers, and wildlife can often be seen.

For park visitors who are not in cars — bicyclists, hikers, campers — other elements become key to their enjoyment of the park. Sounds and smells become increasingly important. The opportunity to enjoy these things is integral to the park's value. Without them, it is simply just another place, and ceases to be a symbol of things created without the human hand. Providing the atmosphere which allows park visitors to relax and feel close to nature is intrinsic to the purpose of the National Park. Tranquility, peace and silence are important attributes of "restorative environments" (Kaplan and Talbot 1983).

The Kootenay Parkway bisects Kootenay National Park. Few areas in the Park are more than 8 km from the road. Traffic noise was mentioned by respondents to the B–A Survey (1988) as one of the factors which lessened their enjoyment of the park.

Road traffic noise is influenced by a number of factors (Central Mortgage and Housing Corporation 1977):

- density: more vehicles are noisier (Table 17)
- composition: heavier vehicles (trucks) are noisier than light ones (passenger cars) (Table 17)
- speed: faster speeds are noisier
- stop and go situations: slowing, stopping and accelerating increases noise
- road gradients: noise from vehicles, especially heavier ones, increases with the gradient (Table 18)
- ground surface: a "soft" ground surface (eg. shrubs and trees) reduces noise if the path of the sound to the receiver is near the ground
- road surface: rough road surfaces produce more noise than smooth ones.

In addition to the park user who actually visits the park, many people enjoy National Parks from afar. They are people who value the park by appreciating that there are areas protected from damage caused by unsympathetic land

Table 17: Equivalent Noise Level at 100 ft. (30m) from Centre Line if Posted Speed Limit is 50 mph (80 kph) (Central Mortgage and Housing Corporation 1977)

DAILY VOLUME	PERCENTAGE OF TRUCKS						
vehicles/ 24 hour	up to 1.0	1.1 to 3.0	3.1 to 5.0	5.1 to 7.5	7.6 to 10	11 to 13	14 to 18
960	53	54	54	55	56	56	57
1200	54	55	55	56	57	57	58
1500	55	56	56	57	58	58	59
1900	56	57	57	58	59	59	60

Note: Values in body of this table are A–weighted noise levels expressed in dB.

Table 18: Correction (in dB) to be Added for Road Gradient (Central Mortgage and Housing Corporation 1977)

Percentage of Trucks	Gradient				
	1%	2%	3%	4%	5%
0 – 7	0	1	1	1	2
8 – 12	1	1	2	2	3
13 – 17	1	1	2	3	3
18 or over	1	2	3	3	4

uses, who enjoy seeing pictures of the beautiful landscapes, and experience a positive feeling from knowing that areas exist which will remain essentially unchanged. It is especially for these people that the National Park must not only be protected, but be seen to be protected.

4.3.2 Significance and Implications

Sightseeing and driving for pleasure are some of the most popular ways in which people enjoy Kootenay National Park. Traffic congestion, heavy trucks and hazardous driving conditions are inimical to that use. In Banff National Park, the Bow Valley Parkway was developed as an alternate sightseeing route because of fast speeds, through traffic and heavy trucks on the Trans Canada Highway. People who wished to sightsee or access many park facilities (eg. trailheads, picnic sites) were unable to do so safely while travelling the Trans Canada. Therefore, the Bow Valley Parkway was redesigned and reconstructed for that important park use.

During the summer of 1988, a survey was conducted to determine if park visitors were disturbed by commercial truck traffic on the Kootenay Parkway (B–A Consulting Ltd. 1988). Park visitors were interviewed during five days in July and August when traffic volumes varied from 1860 to 5932 vehicles per day. The number of large trucks on these days remained relatively constant (ie. 143 to 193 trucks per day), with the proportion of big trucks in the traffic stream varying from 2.6% to 8.7%. (Socio–Economic Research Division, WRO. Data from counter/classifier situated north of Settler's Road). Summer driving conditions prevailed — hot and dry weather on some survey days; cool and wet on others. No survey was conducted to assess visitors' perceptions of commercial trucking during winter driving conditions.

Most survey respondents (79%) indicated that there was nothing about traffic on the Kootenay Parkway which lessened their enjoyment of the park. For the 21% who did indicate there was a problem, road characteristics (eg. need for more passing lanes, poor road conditions) were noted, as were traffic flow characteristics (eg. vehicles speeding, slow vehicles, complaints about trucks). Of the complaints noted, only 6% specified difficulties with big trucks.

When respondents were asked if they had negative experiences with any particular vehicle type, people were most likely (25%) to identify difficulties with cars. Large commercial trucks (20%) and recreational vehicles (19%) were viewed about equally, and vehicles pulling trailers (15%) were also the source of visitors' negative experiences. The most frequent complaints were about speeding, passing dangerously, vehicles travelling too slowly, and large trucks speeding. Less frequently mentioned reasons for complaint were wind from passing trucks, overly aggressive drivers, noise and honking.

There is special concern for bicyclists. They are particularly susceptible to exhaust fumes, noise and wind blast from large vehicles.

Traffic noise detracts from the enjoyment of the natural environment by those who use day–use roadside areas (eg. picnic sites) or stay in campgrounds in the Kootenay Valley. Heavy truck

traffic, particularly on highways like the Parkway which have changing grades and rough road surface, greatly increases traffic noise. As most park users in Kootenay enjoy the park from within a short distance of the road, commercial traffic noise on the parkway affects most of Kootenay National Park's visitors.

In 1988, commercial truck traffic did not appear to be a notable conflict with park visitors' enjoyment (B–A Consulting Ltd. 1988). However, there is a concern that increased levels may intrude on park enjoyment, but at what traffic level this occurs is unknown. There is also concern that under winter driving conditions, a motorist may be less tolerant of heavy vehicles than during good driving conditions.

Increasing commercial truck traffic will result in deteriorated air quality from truck exhaust. Although unlikely to become a serious circumstance for Parkway visitors who are in motor vehicles, it is a noticeable impact to bicyclists.

Conflicts between the aesthetic values of the park to visitors and commercial truck traffic could be minimized or avoided by a number of methods. Although these suggestions would reduce conflicts with aesthetic values, they are not without drawbacks (eg. traffic restrictions may compromise industry economic viability; resiting park facilities would disturb currently undisturbed park lands).

1. Restrict commercial truck traffic to seasons or time of day when use by park visitors is minimal.
2. Improve the road surface to reduce the noise from commercial traffic. Sites of special concern are bridge approaches.
3. Site park facilities away from the traffic (eg. distance picnic sites from the road surface).
4. Enforce strict pollution standards on vehicle emissions on the Kootenay Parkway.
5. Enforce the speed limit to reduce noise and windblast.As density of commercial traffic increases, regular reviews of its impact to park visitor enjoyment of the Parkway should be conducted.

4.4 RECREATION AND VISITOR USE

4.4.1 Description

Recreation in a National Park provides visitors with opportunities to enjoy and understand the park's natural environment. Driving for pleasure is one of the most popular ways that people enjoy the park. Walking, hiking, camping, fishing, picnicking, wildlife observation, photography, rafting and kayaking, cross–country skiing, bicycling and bathing in the Radium Hot Springs Aquacourt are recreational activities where people interact with and enjoy the park's natural features.

Most park use occurs in the summer months and is focussed on a narrow strip of land along the Kootenay Parkway. There are 13 picnic sites, and major viewpoints/pulloffs are located at Valley View, Sinclair Canyon, Kootenay Valley, Mount Harkin, Hector Gorge, Simpson's Monument and Continental Divide. The Radium Hot Springs Aquacourt is open year–round and is the most popular recreational feature in the park.

Frontcountry overnight accommodation in the park is concentrated in the Parkway corridor. Three campgrounds (Marble Canyon, McLeod Meadows and Crook's Meadow) and five outlying commercial accommodation businesses are located adjacent to the Parkway.

The Parkway itself is a major visitor use facility. Physical deterioration of the pavement structure is evident. Past use by significant numbers of overweighted trucks is implicated in premature failure of the road structure (See Section 1.4).

4.4.2 Significance and Implications

Providing opportunities for visitors to enjoy the natural environment is crucial to the purpose of the National Park. Land uses which compromise visitors' opportunity to enjoy a high quality natural experience threaten one of the basic tenets of a National Park.

For most park visitors, driving for pleasure is their first introduction and most important activity in Kootenay National Park. It is from their cars that they acquire their impressions of the atmosphere and attractions of the area. It is essential, therefore, that the Parkway provides a driving experience different from that provided by most commuter highways. The Parkway should convey the impression that it is a place from which to enjoy the park instead of just drive through it.

All roadside facilities — picnic sites, viewpoints, pulloffs — are subject to noise and other disruptions from passing vehicles, and will be affected in particular by larger or noisier vehicles.

If traffic conditions — congestion, fast speed — are such that a motorist is reluctant to stop to take a picture, watch wild animals, or slow down to enjoy the view, then one of the important purposes of the Parkway has been depreciated.

Bicyclists are of special concern because they are particularly susceptible to exhaust fumes, noise and wind blast from large vehicles.

Increased commercial traffic intensifies the need to upgrade intersections to provide safe opportunities for visitors to access key attractions.

Mitigating measures to reduce impacts to recreation and land use of the Parkway are:

1. Schedule commercial use of the Parkway to avoid seasons and times of the day when visitor traffic is highest.
2. Enforce existing speed limits.
3. Enforce vehicle weight limits, especially in the spring.
4. Provide sufficiently wide shoulders for safe bicycling along the entire length of the Parkway.
5. Repair damaged roadway structure.

5.0 SUMMARY OF IMPACTS AND MITIGATING MEASURES

5.1 ACTIVITIES RESULTING IN MAJOR IMPACTS

Although the Kootenay Parkway is the facility which results in the greatest impact to park resources, it is also the facility which provides the greatest opportunity for people to enjoy the park. Impacts to natural resources and visitor enjoyment of the park result from three major activities:

1. **Disturbance to park lands caused by original construction of the Parkway and facility upgrading**

More than 730 hectares of terrain and vegetation were disturbed for the original construction of the Parkway. Although much of this has been revegetated (eg. highway right-of- way), it remains strongly affected by non native vegetation species and the requirement to maintain a cleared right–of–way.

Road upgrading — addition of passing lanes and intersection improvements — will require modest expansion of the pavement surface and may require some right–of–way enlargement as well.

2. **On–going facility maintenance**

Vegetation management to maintain a cleared right–of– way and road salting are notable impacts relating to maintenance of the Kootenay Parkway.

Continuing extraction of gravel for road maintenance purposes will continue to enlarge impacts resulting from borrow pit expansion.

3. **Traffic**

Use of the Parkway by motorvehicles results in some air quality deterioration, increased potential for soil and water contamination caused by material spills, and wildlife mortality.

5.2 POTENTIAL IMPACTS RESULTING FROM INCREASED COMMERCIAL TRUCKING

Increased commercial trucking on the Kootenay Parkway has special implications for the severity and type of some of the environmental impacts relating to the Parkway:

1. **Wildlife Mortality**

Evidence suggests that commercial trucking is implicated in a disproportionately large share of ungulate mortality on the Kootenay Parkway. Current levels of mortality, especially of elk, are of serious concern to park wildlife populations. Increased trucking would increase the severity of this impact unless mitigating measures are implemented and are successful.

2. **Terrain Disturbance**

Increased levels of traffic, including commercial trucking, accelerate the requirement to upgrade intersections and passing lanes on the Parkway. Pavement widening will cause a limited amount of terrain disturbance and associated vegetation impact.

3. **Pollution**

Increasing use of motorvehicles, especially large trucks, increases exhaust emissions and affects air quality. The extent of this impact is localized and has a limited effect beyond the highway right–of–way.

Increased hauling of potentially hazardous materials along the Kootenay Parkway increases the risk of spills which could contaminate soils and water. Although the likelihood for spills may be small, the potential seriousness of impacts could be severe.

4. Social Impacts

Park visitors during the summer are not significantly disturbed by the existing levels of commercial trucks on the Kootenay Parkway. If the density of commercial traffic increases, further evaluation of the impact of trailer truck trains on park visitors' enjoyment should be undertaken.

Commercial vehicles are involved in a disproportionately large share of traffic–related emergencies. This implies that an increase in commercial traffic would increase public safety concerns along the Parkway, and would accelerate the urgency to upgrade the highway to meet modern safety standards (eg. intersection improvements and addition of passing lanes).

5.3 MAJOR MITIGATING MEASURES

The most important measures to mitigate impacts address factors relating to Parkway design, Parkway maintenance, traffic management and vegetation management.

1. Parkway Design

For the existing Parkway:

- Improve roadside visibility at locations along the Parkway where ungulate kills are concentrated.
- Rehabilitate areas which were disturbed by previous road construction.

Considerations for pavement widening at selected locations:

- Limit pavement widening wherever terrain disturbance would result.
- Source borrow material outside the National Park.
- Avoid any road widening which would damage significant species (eg. western larch) or habitats (eg. Goat Lick).
- Widen pavement where required to provide safe passage for bicyclists.
- Evaluate each potential disturbed site for the potential and significance of archaeological resources.

2. Parkway Maintenance

- Minimize the use of pavement de–icing agents, particularly sodium chloride.
- Develop site–specific mitigation measures to limit resource impacts wherever stream control is required.
- Protect trees from snow removal damage (eg. along Settler's Road).
- Ensure that clean–up materials and knowledgeable staff are available to undertake emergency clean–up and containment of toxic material spills.
- Avoid roadside mowing during times when plant growth would be stimulated.
- Strictly enforce load limits to prevent highway damage.
- Avoid exposing vegetation adjacent to the pavement surface during snow removal.

3. Traffic Management

Methods to reduce vehicular threat to wildlife are:

- Restrict commercial traffic use of the Kootenay Parkway during times of particularly severe ungulate kill periods and seasons (ie. During October–November and June–July limit truck traffic to the daylight period to reduce elk and deer mortality.)
- Enforce existing speed limits.
- Reduce night–time speed limit for all traffic at high hazard locations during periods of high ungulate mortality (ie. October–November and June–July).

- Increase driver awareness of locations and times when wildlife collision hazard is greatest.

Methods to reduce the potential for impacts related to hazardous material transport are:

- Require carriers of hazardous goods to use alternate transportation routes (eg. Trans Canada Highway).
- Permit transport of hazardous materials through the park only when road conditions are optimal for safe vehicle operation.
- Require that all vehicles transporting potentially hazardous materials meet all equipment and maintenance standards.
- Ensure that response plans, equipment and trained staff are available to deal quickly with spills.

Other traffic management methods to control existing and potential impacts are:

- Require strict pollution control standards to minimize emissions from all motorvehicles.
- Schedule commercial traffic during low–visitor use periods and monitor visitor perception of commercial traffic.

4. Vegetation Management

- Implement vegetation management programs to provide ungulate habitat away from the Parkway corridor.

5.4 SUMMARY

The Kootenay Parkway has impacts on park resources and visitor use in Kootenay National Park. In particular, the current level of wildlife mortality resulting from collisions with vehicles, particularly commercial trucks, is a serious concern and is unacceptable.

It appears, however, that a number of measures could be implemented to reduce the degree of impact which now occurs. **If these measures prove to be effective**, current levels of commercial traffic could be maintained without causing unacceptable impacts. An increased volume of commercial traffic may be acceptable during time periods when conflicts with wildlife or visitors are least likely.

6.0 PUBLIC CONSULTATION

Public consultation has been a component of the development of the Kootenay Parkway Area Plan from the initial stages. The Kootenay National Park Management Plan, approved in 1988 (Canadian Parks Service, 1988) indicated: *"No action will be taken to implement any mitigative response without full consultation with all parties who would be directly affected".*

Subsequently, a socio-economic survey which examined people's perception of the Parkway was conducted (B-A Consulting 1988). Consultative meetings, both with the general public and with special interest groups, have been held. In addition, a standing committee has been struck, comprised of representatives of industrial users of the Kootenay Parkway and from the Canadian Parks Service. The purpose of the committee is to address on an on-going basis, issues relating to commercial use of the Parkway.

7.0 KNOWLEDGE DEFICIENCIES & OUTSTANDING ISSUES

A number of knowledge deficiencies remain relating to the assessment of environmental impacts of commercial trucking on the Kootenay Parkway and Settler's Road in Kootenay National Park.

1. The significance of vehicle caused wildlife mortality is unclear.

   Poll's (1989) analysis of wildlife mortality provided substantial information about ungulate/vehicle collisions on the Kootenay Parkway. Although he was able to draw a number of preliminary conclusions from his research, further investigation is required to determine:

   - the status and dynamics of wildlife populations within the park and the effects of habitat change due to forest succession,
   - accurate number of animals killed, and
   - wildlife populations' ability to withstand vehicle – caused mortality.

2. The effectiveness of a number of potential methods to reduce wildlife susceptability to vehicle-caused mortality is unknown, requiring investigation of the use of:

   - roadside reflectors (eg. Swareflex reflectors)
   - noise making devices (eg. Hobi whistles)
   - vegetation management to create habitat elsewhere and/or reduce the attractiveness of the right-of-way, and
   - speed limit reductions.

3. The relative impact of different vehicle types (eg. trailer-truck trains, recreational commuters) and traffic scheduling (eg. night time vs daylight) need to be more thoroughly documented in order to base traffic management strategies on reliable data and effectively reduce wildlife mortality.

4. The tolerance level of park visitors to commercial trucking is unknown.

   Survey information collected from park visitors in 1988 indicated that most roadside visitors were not disturbed by the level of commercial traffic which occurred on the Kootenay Parkway in the summer.

   The affect of commercial traffic to park visitor's perception of Kootenay National Park during the winter, with winter driving conditions, remains unknown.

   Follow–up testing is required as levels of traffic increase and/or the density of commercial trucks in the traffic mix changes to determine if there is a level at which commercial trucking does present a significant impact to the park visitors' enjoyment of the natural environment.

5. Practical alternatives to the use of salt as a Parkway de–icing agent are unavailable.

   Sodium chloride is a cost–effective method of de–icing the Parkway during winter driving conditions. Its environmental effects include attracting wildlife to the highway surface, and contamination of adjacent soils and water. Further research is required to:

   a) assess the extent and severity of salt–caused contamination to soils, water, vegetation and

   b) to identify environmentally and economically viable options to the use of sodium chloride as a deicing agent.

6. The impact of dust from traffic along Settler's Road to vegetation is unknown. A monitoring program is required to determine if road dust is effecting vegetation adjacent to Settler's Road, with specific attention directed to the effects of magnesite dust.

8.0 CONCLUSIONS

The Kootenay Parkway negatively effects the natural resources of Kootenay National Park. However, a number of mitigating measures have been identified which may reduce the impacts of maintenance and use of the Kootenay Parkway.

The most important impact is wildlife mortality which results from collisions with motor vehicles. Commercial trucks are of particular concern. Mitigating measures which may reduce this problem are a combination of controlling the number and scheduling of trucks, reducing the speed of all traffic during periods and locations of high wildlife collision risk, and increasing driver awareness of potential hazard. These methods, together with techniques such as reflector devices, may prove effective in reducing the impact of current levels of traffic.

Many of these measures are unproven, and must be monitored to determine their effectiveness. Others (eg. restriction of commercial traffic during some periods of time), are detrimental to the economic viability of industry.

Some highway maintenance activities also contribute to wildlife mortality by attracting animals to the road surface. Using deicing salts and some right–of–way maintenance practices need re–examining to identify more environmentally appropriate techniques.

At current traffic levels, it does not appear that commercial truck traffic significantly disturbs other park motorists during the summer. The effect of commercial trucking to a visitor's enjoyment of the park during winter driving conditions, or under higher levels of truck traffic are unknown and must be investigated if commercial traffic increases are to be considered.

Without the implementation of measures which are successful in reducing the environmental impacts of existing levels of commercial traffic, an increase in commercial trucking is unacceptable because of increased conflicts with park resources and potential effects to visitor use of Kootenay National Park.

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